An Annotated Discrete Event Simulation Bibliography

By M. C. (Mike) Albrecht, P.E. (AZ)

1. Abrams, M., E. H. Page, and R. E. Nance, 1991, "Simulation program development by stepwise refinement in UNITY," *Proceedings of the 23rd conference on Winter simulation*, Dec-91

   Abrams, Page and Nance (1991) describe a UNITY-based methodology for the construction, analysis and execution of simulation models. Their methodology (based on work by Chandy and Misra) starts with a simulation model specification in the form of a set of coupled state transition systems and moves on through validation. The program is aimed for high level PDES applications. The system uses six (6) steps:

   I. Generate a communicative model in the form of a coupled state transition system (CSTS),
   II. The automated generation of a UNITY program from the CSTS.
   III. Automated generation of UNITY assertions from the CSTS
   IV. A time flow mechanism is superposed on the UNITY program
   V. Map the program resulting from step four to a target computer architecture.
   VI. Maps the program resulting from step five to a simulation protocol for sequential or parallel execution.

   This system had more relavance15 years ago, when there was less commonality in operating systems, and specific computer architecture was more critical.

2. Adams, M., P. Componation, H. Czarnecki, and B. J. Schroer, 1999, "Simulation As A Tool For Continuous Process Improvement," *Proceedings of the 1999 Winter Simulation Conference* P. A. Farrington, H. B. Nembhard, D. T. Sturrock, and G. W. Evans, eds.

   Adams, et al. (1999) present the use of simulation in reliability in particular in lean manufacturing operations. They briefly tell how manufacturing developed from Ford's mass production, through the Toyota system to lean manufacturing. They then show the use of simulation in the continuous improvement cycle of lean manufacturing. They describe the use of Promodel in two applications (general manufacturing and an aerospace manufacturer). Only general results are given.

3. Adamyan, A. and D. He, 2004, "System Failure Analysis Through Counters of Petri Net Models," *Quality and Reliability Engineering International* Volume 20, Issue 4, Date: June 2004, Pages: 317-335

   Adamyan and He (2004) compare Petri nets to fault trees for analysis of sequential failures. They show how Petri nets can be augmented to provide better information than fault trees. They provide the mathematical development of using counters to determine which subsystem is failing most often. They then provide an example of using Petri nets for failure analysis for a nitric acid cooler.

4. Aedo Ortiz, D. M., 2003, “Interactive Simulator Of Western Logging Systems,” *PhD Dissertation*, University of Idaho, January 2003

    Aedo (2003) simulates timber harvesting using a discrete event simulator (Promodel PC interfaced with Excel by Visual Basic macros). He describes the problems associated with modeling a system with varying transport distances and work station requirements. He presents the steps and methods used to develop a functioning general purpose timber harvesting simulator. The system was verified using case studies, but not validated.

5. Aguilar, M., T. Rautert and A. J.G. Pater, 1999, “Business Process Simulation A Fundamental Step Supporting Process Centered Management,” *Proceedings of the 1999 Winter Simulation Conference*, P. A. Farrington, H. B. Nembhard, D. T. Sturrock, And G. W. Evans, Eds.

    Aguailar, Rautert, and Pater (1999) discuss the importance of simulation in studying business processes. They examine the use of decision support systems in looking ahead at what could happen. They use an example from the Banque Générale du Luxembourg of how simulation is used in developing a process centered management system in a banking environment.

6. Aguilar-Lasserre, A., M. Bautista Bautista, A. Ponsich, and M. González Huerta, 2009, "An AHP-based decision-making tool for the solution of multiproduct batch plant design problem under imprecise demand," Computers & Operations Research, Volume 36, Issue 3, March 2009, Pages 711-736

    Aguilar-Lasserre, et al. (2009) discusses multi-criteria batch plant design in specialty chemicals, food products and pharmaceutical industries under imprecise demand. They present that in the design (*and operation*) of a batch processing plant there is some imprecision in required production rates. The design *(and operation*) depends on how the equipment is utilized, which inserts some fuzzy parameters into the requirements. This means that scheduling and planning of operations can significantly impact the design *(or operation*). This creates a multi-objective optimization problem. Aguilar-Lasserre, et al. uses the analytic hierarchy process to improve on the non-denominated results from a genetic algorithm approach to optimization.

7. Ahmed, R., T. Hall, and P. Wernick, 2003, “A Proposed Framework for Evaluating Software Process Simulation Models,” *Proceedings Prosim’03* May 3-4 2003, Portland state University

    Ahmed, Hall and Wernick (2003) describe the development and rational for a formal evaluation criteria for a simulation. They present the background for developing a formal set of criteria and summarizes previous work by others. This builds on the work by Kitchenham, and proposes five main criteria:

    - syntactic quality,
    - semantic quality,
    - pragmatic quality,
    - test quality
    - maintainability.

Their work is a refinement over previous work by including enhancement of semantic quality and the addition of maintainability. They also consider the value of the simulation in their framework.

8. Akerkar, S. R , 2004, “Analysis And Visualization Of Time-Varying Data Using The Concept Of ‘Activity Modeling’,” *MS thesis The University Of Arizona*

   Akerekar (2004) describes a method to assist in visualizing large amounts of time varying data. His method considers only active areas by employing the concept of "Activity modeling". Visualization of large amounts of data can consume large amounts of computer time. But, often only certain areas of the topology are changing. To assist in the visualization his method only refreshes the active regions.

9. Al-Aomar, R., 2000, “Product-Mix Analysis With Discrete Event Simulation,” *Proceedings of the 2000 Winter Simulation Conference*, J. A. Joines, R. R. Barton, K. Kang, And P. A. Fishwick, Eds.

   Al-Aomar (2000) is an examination of the use of DES. He describes the use of a DES (AutoMod) as an analysis tool for product mix selection. His paper examines using a DES in place of linear programming (LP). It provides an example from the toy industry in modeling a production facility.

10. Al-Aomar, R., 2006, “A simulation-based DFSS for a lean service system,” *International Journal of Product Development*, Vol. 3, Nos. 3/4, 2006 349

    Al-Aomar (2006) proposes using DES as part of Lean Six sigma approach to process design, particularly in relation to a lean service system. He modifies the standard DFSS-IDOV approach to better suit a lean service organization. Primary use of DES is in the verification stage. He shows how to use other tools (QFD, P-diagram, etc) and interface them with the DFSS-IDOV concept. He also shows how it can interface with both an existing and a new operation.

11. Albrecht, M. C., 2005, "Equipment Sizing Of A Material Handling System Using Discrete Event Simulation," *Proceedings of the 32nd International Symposium on the Application of Computers and Operations Research in the Mineral Industry (APCOM) 2005)*, Tucson, USA, 30 March - 1 April 2005 Editor(s) - Sean Dessureault, Rajive Ganguli, Vladislav Kecojevic, Jami Girard-Dwyer

    Albrecht (2005) presents the use of DES (Sigma) in the sizing of a mining material handling system. By simulating the actual operation versus using traditional rule of thumb measures, the system size can be reduced.

12. Alexander, C. W., 2006, "Discrete event simulation for batch processing," *Proceedings of the 38th conference on Winter simulation,* Pp. 1929 – 1934

    Alexander (2006) presents the use of DES as an alternative to standard scheduling (e.g. using Microsoft™ Project) evaluating process cycle time and interactions between various phases of the process. Alexander uses iGrafx® Process™ 2003 for Six Sigma from the Corel Corporation for his analysis.

13. Allaoui, H. and A. Artiba, 2004, "Integrating simulation and optimization to schedule a hybrid flow shop with maintenance constraints," *Computers & Industrial Engineering*, Volume 47, Issue 4, December 2004, Pages 431-450

    Allaoui and Artiba (2004) present a methodology for approaching a hybrid simulation of a shop. They describe a hybrid flow shop, and explain methods for the analysis. They use heuristics and simulated annealing, and then show how to integrate into a hybrid. They provide a simplified example

14. Alrefaei, M. H. and A. J. Alawneh, 2004, "Selecting the best stochastic system for large scale problems in DEDS," *Mathematics and Computers in Simulation*, Volume 64, Issue 2, 27 January 2004, Pages 237-245

    Alrefaei and Alawneh (2004) analyze how to select the optimal system by stochastic methods. They describe a statistical approach for simulation optimization and recommend performing parallel DES runs as an alternative to massive runs. This is applicability to PDES and in hybrid optimization

15. Ang, A. and I. Sivakumar, 2007, "Online Multiobjective Single Machine Dynamic Scheduling With Sequence-Dependent Setups Using Simulation-Based Genetic Algorithm With Desirability Function," *Proceedings of the 2007 Winter Simulation Conference*, S. G. Henderson, B. Biller, M.-H. Hsieh, J. Shortle, J. D. Tew, and R. R. Barton, eds.

    Ang and Sivakumar (2007) present a hybrid simulation system using a simulation-based genetic algorithm with desirability function (SIMGAD) for determining the weights to schedule an ion-implanter subjected to multiple conflicting objectives and sequence-dependent setups in semiconductor manufacturing.

16. Anglani, A., A. Grieco, M. Pacella and T. Tolio, 2002, "Object-oriented modeling and simulation of flexible manufacturing systems: a rule-based procedure," *Simulation Modelling Practice and Theory* Volume 10, Issues 3-4, 15 November 2002, Pages 209-234

    Anglani, et al (2002) presents an example of the use of a DES for the design of a flexible manufacturing system. Starting with the definition of what a flexible manufacturing system is they then describe how object-oriented systems can be used for DES modeling. They present a procedure for interfacing the DES (in ARENA) with the rule base to achieve the overall system. Their system (procedure) is called (unified modeling language Modeled SIMAN Implemented Simulation software (UMSIS)).

17. April, J., M. Better, F. Glover, and J. Kelly, 2004, "New Advances And Applications For Marrying Simulation And Optimization," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

    April, et al. (2004) provide a general overview of using simulation for optimization. They describe general optimization methods and how simulation can be used with them. Their approach is an iterative approach where the

analytical phase is used to feed the simulation and to analyze the results. They use Tabu Search, Scatter Search, Mixed Integer Programming, and Neural Networks for their optimization. Note: paper is general in nature an primarily selling OptiQuest, it is also a reprise of April, et al. (2001). For the portfolio analysis they use Monte Carlo simulation, and for the supply chain example they use some unnamed DES which they do not describe.

18. April, J., F. Glover, J. Kelly, and M. Laguna, 2001, "Simulation/Optimization Using "Real-World" Applications," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

April, et al. (2001) present examples of DES optimization using OptiQuest. They describe general optimization methods and how simulation (OptiQuest) can be used with them. heir approach is an iterative approach where the analytical phase is used to feed the simulation and to analyze the results. They use Tabu Search, Scatter Search, Mixed Integer Programming, and Neural Networks for their optimization. Note: paper is general in nature and primarily selling OptiQuest.

19. Arsham, H., 1998, "Algorithms for sensitivity information in discrete-event systems simulation," *Simulation Practice and Theory*, Volume 6, Issue 1, 15 January 1998, Pages 1-22

Arsham (1998) gives a method to evaluate a discrete event system using an analysis of the sensitivity of DES. The purpose being to improve the results for solving problems and to provide some analytical tools to reduce the need for replicate runs. His work is based on the study of the sensitivity of the simulation results to changes to input. He provides an introduction to sensitivity analysis and then examines four (4) methods of performing sensitivity analysis:

- Change of probability measure, which uses the likelihood ratio and the score function to get the finite difference.
- Frequency domain approach which uses harmonic difference to get the finite difference.
- Performance evaluation, which uses simultaneous perturbation to get the finite difference.
- And simple path reconstruction, which uses perturbation analysis to get the finite difference.

He concludes that using the change of probability measure (likelihood ratio and the score function) approach can be as accurate as simple path reconstruction (perturbation analysis) but easier to implement, and more accurate then the others.

20. Arthur, J. D., R. E. Nance, R. G. Sargent, D. R. Wallace, L. H. Rosenberg, and P. R. Muessig, 1997, "Verification, Validation & Accreditation : Disciplines In Dialogue Or Can We Learn From The Experiences Of Others? Panel Presentation," *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Arthur, et al. (1997) on a panel discussion on V&V from various perspectives. They each respond to nine (9) questions definition

- goals
- relative importance of verification, validation and accreditation
- how well applied
- status of accreditation
- testing when, how, what
- top 3 impediments to V&V
- if had to choose which is more important verification or validation
- role of documentation, models, programs, and data

21. Artigues C. and F. Roubellat, 2001, "A Petri net model and a general method for on and off-line multi-resource shop floor scheduling with setup times," International Journal of Production Economics, Volume 74, Number 1, December 2001, pp. 63-75(13)

    Artigues and Roubellat (2001) use Timed Petri Nets to model a shop production system and as the active component in a decision support system. By establishing the states and activities and then comparing alternatives improved production rates can be achieved. Each set of solutions is assumed to be static by itself, the sequencing is modified.

22. Auriche, L. R. G, F. Quaglia and B. Ciciani, 1998, "Run-time selection of the checkpoint interval in Time Warp based simulations," *Simulation Practice and Theory*, Volume 6, Issue 5, 15 July 1998, Pages 461-478

    Auriche, Quaglia, and Ciciani (1998) discuss the time warp method for synchronization of PDES. They describes the two techniques for synchronizing: periodic and incremental. And then present a study of the periodic technique, and present an analytical model for analysis. They derive a methodology that allows each LP to adapt its state saving period on line to reduce overhead

23. Bahr, H. A. and R. F. Demara, 2004, "Smart priority queue algorithms for self-optimizing event storage," *Simulation Modelling Practice and Theory* Volume 12, Issue 1, April 2004, Pages 15-40

    Bahr and Demara (2004) describe an algorithm to manage queues with less overhead. They propose that their method will optimize DES performance. Based on a review of the use of queues in DES, they describe smart priority queues. They contrast their method to existing methods and present a method of application.

24. Bahri, N. and R. J. Gaskins, 2000, "Automated Material Handling System Traffic Control By Means Of Node Balancing," *Proceedings of the 2000 Winter Simulation Conference* J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds. "

    Bahri and Gaskins (2000) presents the development of an algorithm for modeling automated transporters. They compares the results using the algorithm with a baseline conventional approach. Their results indicate that the new algorithm

improved transporter uses. The work uses AutoMod for developing the simulation model.

25. Baines, T., S. Mason, P.-O. Siebers and J. Ladbrook, 2004, "Humans: the missing link in manufacturing simulation?," *Simulation Modelling Practice and Theory* Volume 12, Issues 7-8, November 2004, Pages 515-526

Baines, et al. (2004) describe a concept for including human performance in DES. Based on an overview of DES and its application in manufacturing, they describes how they plan to incorporate a human performance model. Based on alternative model concepts:

- age related performance theory
- circadian rhythm related performance theory

Baines, et al. describe how the DES model responded with the human performance models. They onclude that it is important but more work is needed.

26. Balakrishnan, V., R. Radhakrishnan, D. M. Rao, N. Abu-Ghazaleh and P. A. Wilsey, 2001, "A performance and scalability analysis framework for parallel discrete event simulators," *Simulation Practice and Theory*, Volume 8, Issue 8, 15 July 2001, Pages 529-553

Balakrishnan, et al. (2001) propose a taxonomy (performance and scalability analysis framework) (PSAF) for generating efficient PDES code. Their system is based on the workload specification language (WSL) combined with the Purdue complier construction tool set to generate basic code in alternative languages. While the states goal of their system is to assist in V&V of PDES it can be used for other non-PDES implementations. They describe using a set of parameters in the PSAF to define the system:

- Simulation Object related
  - Input and output behavior
  - Distribution
  - Delay
  - State size
- Event related
  - Computation granularity
  - Event Size
  - Event population
  - Event probability
- Communication related
  - Type of connectivity (topology)
  - Number of processors
  - Number of simulation objects

They use a synthetic workload generator (SWG) coupled with the PSAF on a PDES network ping problem. Comparisons of different numbers of parallel logical processes are reported based on network ping simulation for the system developed using the PSAF method. Comparisons of different translators are shown. They also propose using this system with the SWG to evaluate other simulation systems.

27. Balasubramanian, J. and I. E. Grossmann, 2004, “Approximation to Multistage Stochastic Optimization in Multiperiod Batch Plant Scheduling under Demand Uncertainty,” *Industrial & Engineering Chemistry Research* ; 2004; Volume 43, issue 14, pp 3695 3713

Balasubramanian and Grossmann (2004) present a case in solving a scheduling problem for a chemical batch plant using mixed integers and two-stage approach. Their method involves stochastic solutions.

28. Balbo, G., J. Desel, K. Jensen, W. Reisig, G. Rozenberg, and M. Silva, 2000, “Introductory Tutorial Petri Nets,” 21st *International Conference On Application And Theory Of Petri Nets* Aarhus, Denmark, June 26-30, 2000

Balbo, et al. (2000) provide a series of presentations on the organization and use of Petri Nets. Topics covered include:

- An Informal Introduction to Petri Nets
- Elementary Net Systems
- Place/Transition Nets I
- Colored Petri Nets
- Behavior of Elementary Net Systems
- Place/Transition Nets II
- An Introduction to Generalized Stochastic Petri Nets

29. Balci, O., 1988, “The implementation of four conceptual frameworks for simulation modeling in high-level languages,” *Proceedings of the 1988 Winter Simulation Conference* M. Abrams, P. Haigh, and J. Comfort (eds.)

Balci (1998) describes four conceptual alternative DES frameworks based on how they approach the problem (later called world views by others)

(1) VV&A event scheduling,
(2) activity scanning,
(3) three-phase approach,
(4) process interaction.

He provides an overview of the background and terminology for DES and provides simplified flowcharts of each framework

30. Balci, O., R. E. Nance, 1992, "The simulation model development environment: an overview", *Proceedings of the 24th conference on Winter Simulation*, Dec-92 pp 726-736

Balci and Nance (1992). they present an idealized framework for the development of a simulation IDE (they use the term simulation model development environment (SMDE)). They state that the purpose of the IDE is to:

- offer cost-effective, integrated and automated support of model development throughout the entire model life cycle;
- improve the model quality by effectively assisting in the quality assurance of the model;

- significantly increase the efficiency and productivity of the project team; and
- substantial decrease the model development time.

They define that their idealized IDE is to have four layers:

(0) Hardware and Operating System,
(1) IDE Kernel,
(2) Minimal IDE, and
(3) IDES.

The framework presented by Balci and Nance (1992) was used for developing the "Computer-Aided Simulation Software Engineering Environment" and the "Simulation Support Environment" at Virginia Tech.

31. Balci, O., 1998, "Verification, Validation, And Accreditation," *Proceedings of the 1998 Winter Simulation Conference*, D.J. Medeiros, E.F. Watson, J.S. Carson and M.S. Manivannan, eds

Balci (1998) presents a set of guidelines for V&V of modeling and simulation. He gave a succinct definition of verification and validation as:
"…. Model verification deals with building the model right. … Model validation deals with building the *right* model. …"

32. Balci, O., R. E. Nance, J. D. Arthur, and W. F. Ormsby, 2002, "Expanding Our Horizons in VV&A Research and Practice," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Balci, et al (2002) discuss that as DOD is probably largest M&S user and developer, they are driving force to define V&V and achieve it more uniformly. They then presents 13 areas to improve V&V

(1) Expanding VV&A from accuracy centered assessment to quality centered assessment
(2) Expanding VV&A from product centered assessment to (product / process / project)-centered Assessment
(3) Developing M&S applications using the component-based technology
(4) Practicing VV&A in an independent manner
(5) Providing computer-aided support for VV&A
(6) Developing effective techniques for measurement and evaluation of qualitative elements
(7) Developing effective techniques for utilizing some knowledge
(8) Practicing accreditation and certification under a comprehensive scheme
(9) Resolving the terminology problem
(10) Improving the quality of the VV&A plan and its execution
(11) Improving the relationship between the M&S application developer and the independent VV&A agent
(12) Providing comprehensive education for VV&A
(13) Disseminating the VV&A experience

They propose a more formalized approach, with emphasis from other areas and work (eg. ISO 900x and TQM)

33. Balci, O. and S. D. Saadi, 2002, "Proposed Standard Processes For Certification Of Modeling And Simulation Applications," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Balci and Saadi (2002) propose treating M&S V&V in a manner similar to ISO 900x certification by establishing standard procedures and have a third party certification agency. The goal is to achieve better results with early detection of potential problems. They define the components of V&V (especially for DOD M&S)

- Accuracy
- Verity
- Validity
- Clarity
- Unambiguity
- Understandability
- Completeness
- Consistency
- Feasibility
- Modifiability
- Stability
- Testability
- Traceability

34. Baldwin A.N., S. A. Austin, T. M. Hassan and A. Thorpe, 1998, "Planning building design by simulating information flow," *Automation in Construction*, December 1998, vol. 8, iss. 2, pp. 149-163

Baldwin, et al. (1998) present that engineering design management is a dynamic complex process and that common management tools view the system in a simplistic manner focusing on the output of deliverables rather than the information flow required to achieve the deliverables. They propose the use of DES for scheduling and planning engineering and design projects. They discuss how DES can be used to plan the flow. They present a system that uses data flow diagrams (DFD's) and a design structure matrix (DSM) to generate a work flow diagram. They also present that the DFD's have a hierarchical structure. From the DFD's and the DSM a simulation model is developed to model the deign workflow. The DFD and DSM are also used as input to the model. They created a proprietary DES to use the DFD and DSM work. They compared their results to other work using CYCLONE for a similar concept with similar results.

35. Balmer, D. W. and R. J. Paul, 1986, "CASM-The Right Environment for Simulation," *The Journal of the Operational Research Society* Vol. 37, No. 5 (May, 1986), pp. 443-452

Balmer and Ray (1986) describe Computer Aided Simulation modeling (CASM) for automating simulation. Project was an early work to form what is now called an Integrated Development Environment (IDE) for developing and preparing a simulation model. Key part was improving graphical components.

36. Balsamo, M. S. and C. Manconi , 1998, "Rollback overhead reduction methods for time warp distributed simulation," *Simulation Practice and Theory*, Volume 6, Issue 8, 15 December 1998, Pages 689-702

Balsamo and Manconi (1998) discuss factors relating to the rollback algorithm for time warp synchronization in PDES. They describe the time warp concept for synchronization of PDES. They present a method to reduce CPU overhead for a rollback algorithm.

37. Banks, J. and R. Gibson, 1997, "Selecting simulation software," *IIE Solutions*, May 1997, pp. 30-32

Banks and Gibson (1997) present an overview of how to select simulation software. With the large number of DES packages available, the user needs to make a careful selection for most suitable. They provide guidelines to make general evaluation in five (5) area: input processing, output, environment, vendor, and cost. They highlight three (3) items (warnings) that need to be considered:

- know which features are are appropriate for your situation
- don't judge on the basis of yes and no (in overview check boxes)
- you may not need certain features

38. Banks, J., 1999, "Introduction to simulation,," *Proceedings of the 1999 Winter Simulation Conference*, IEEE, pp. 7–13. in P. A. Farrington,H. Black Nembhard, D. T. Sturrock and G. W. Evans (eds),

Banks (1999) provides one in a an annual series on Simulation. He uses a simple bank teller/server system as an example, and runs a 20 customer simulation by hand. He then discusses what simulation and modeling is and leads into DES. He describes some of the pros and cons of simulation and problems that can occur. He concludes with a description of the steps in a simulation study.

39. Banks, J., 2000, "Introduction to simulation,," *Proceedings of the 2000 Winter Simulation Conference* J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds.

Often cited reprise of his 1999 paper (minor editorial changes).

40. Banks, J., Panel Chair, 2000, "Simulation In The Future," *Proceedings of the 2000 Winter Simulation Conference* (Joines, J.A. Barton, R.R. Kang K. and Fishwick, P.A, eds).

Panel discussion on the status (overview of future) of simulation in 2000.

41. Barros, F. J. and M. T. Mendes, 1997, "Forest fire modelling and simulation in the DELTA environment," *Simulation Practice and Theory*, Volume 5, Issue 3, 15 March 1997, Pages 185-197

Barros and Mendes (1997) present a hybrid DES based on DELTA used for simulating a forest fire. The system uses a formalism that allows the simulation structure to evolve over time as conditions change. Their system (Dynamic Structure Discrete Even System Specification (DSDEVS)) can change and adapt based on external input. The change is by the addition and removal of cells from the structure formalism.

42. Bar-Yam, Y., 2003, "When systems engineering fails - -toward complex systems engineering," *IEEE International Conference on Man and Cybernetics*, 2003. 5-8 Oct. 2003 Volume: 2, On page(s): 2021- 2028 vol.2

Bar-Yam (2003) reviews why many large systems projects fail, much of this comes from using old system engineering concepts to implement new technologies. He proposes the application of complex systems theory to such projects.

43. Bar-Yam, Y., 2005, "About Engineering Complex Systems: Multiscale Analysis and Evolutionary Engineering," *Engineering Self Organising Systems: Methodologies and Applications*, S. Brueckner, G. Di Marzo Serugendo, A. Karageorgos, R. Nagpal (Eds.), ESOA 2004, LNCS 3464, Springer-Verlag, 16-31, 2005

Bar-Yam (2005) presents that beyond some size (dependent on actual projects) complex systems cannot be defined by decomposition because the verity and scale can lead to more options then simple decomposition would account for. Use of multiscalar analysis is presented to identify this region and to define the complexity.

44. Bachelet, B. and L. Yon, 2007, "Model enhancement: Improving theoretical optimization with simulation," *Simulation Modelling Practice and Theory*, Volume 15, Issue 6, July 2007, Pages 703-715

Bachelet and Yon (2007) propose using simulation as a stage in optimization to improve efficiency. They present that using purely mathematical models may require extensive simplifications in system operation, which while theoretically good have problems in practice. But, using pure DES requires extensive modeling time, which pure mathematical models can solve quickly.

45. Benjaafar, S., 2002, "Modeling And Analysis Of Congestion In The Design Of Facility Layouts," *Management Science* Volume: 48. May 2002, Number: 5. Pgs: 0679-0704

Benjaafar (2002) presents the concept that minimizing work in process can give different results in optimizing than using quadratic assignment when performing a lean or just in time improvement study. Benjaafar compares the development of a WIP to QAP model and compares the results. Using a model developed in ARENA he uses a generic assembly operation with various transport devices.

46. Benjamin, P., M. Graul and M. Erraguntla, 2002, "Toolkit For Enabling Adaptive Modeling And Simulation (Teams)," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Benjamin, Graul, and Erraguntla (2002) described the development of an expert system for integration with a dynamic simulation model. They present how NASA uses the system for evaluating alternative project concepts (space craft development). They evaluates alternative projects on a cost/benefit basis including schedule. The system is based on Prosim.

47. Benjamin, P., M. Patki, and R. Mayer, 2006, "Using Ontologies for Simulation Modeling," Proceedings of the 37th conference on Winter simulation, 2006, Monterey, California December 03 - 06, 2006, Pages: 1151 – 1159

Benjamin, Patki, and Mayer (2006) present the use of ontologies for simulation and modeling. They identify four stages in the modeling process; Establish Purpose & Scope, Formulate Conceptual Model, Acquire and Analyze Data, and Design Detailed Model. In each of these four areas they identify ontologies can be used.

Simulation Modeling Activity	**Activity Description**	**Role of Ontologies**
Establish Purpose & Scope	Capture needs, questions, objectives. Integrate across multiple perspectives. Map organization / mission goals to simulation goals.	Terminology harmonization to enable shared and clear understanding.
Formulate Conceptual Model	Validate system descriptions. Identify model boundaries. Identify level of modeling abstraction. Identify model objects and roles. Determine model structure and logic.	Ontology knowledge is used to determine the unambiguously differentiated abstraction levels. Ontological analysis helps to map system objects to model objects and to identify appropriate object roles. Ontological analysis helps reason with system constraints to facilitate determination of model logic.
Acquire and Analyze Data	Identify data sources and data dictionaries. Perform data and text mining. Perform statistical analyses, data reduction (distribution fitting, etc.).	Ontologies play an important role in detailed data analysis, especially in disambiguating terminology and interpreting text data descriptions.
Design Detailed Model	Refine, detail, and validate model objects. Refine, detail, and validate model structure and model logic.	Ontologies will facilitate detailed analysis of objects and constraints including mapping the simulation model constraints to evidence / specifications of real world constraints in the domain descriptions.

They present their version of using ontologies in simulation as Ontology-driven Simulation Modeling Framework (OSMF). The OSMF is a set of libraries containing templates interconnected by a GUI. Rather than a true ontology their system (OSMF) appears to be IDE for their simulation system.

48. Birtwistle, G. and C. Tofts, 1997, "Relating operational and denotational descriptions of Pi Demos," *Simulation Practice and Theory*, Volume 5, Issue 1, 15 January 1997, Pages 1-33

Britwistle and Tofts (1997) present piDEMOS and process algebra. They describe the structure of piDEMOS and provide an overview of the use of process algebra. They give examples of how to translate from one to the other

49. Birtwistle, G. and C. Tofts, 2001, ""Getting Demos models right. (I). Practice Getting Demos models right. (II) … and theory"," *Simulation Practice and Theory*, Volume 8, Issues 6-7, 15 March 2001, (I) Pages 377-393 & (II) Pages 395-414

Britwistle and Tofts (2001) pesents a method of validating large simulations using process algebra. Their method can identify deadlocks, livelocks, and operation issues. Their work is based on Discrete Event Modeling on Simula (DEMOS) but they have assumed general applicability. In part I yhey present a an example showing modeling in DEMOS and using Process algebra (CCS & SCCS), and how a deadlock can be identified. They also provide an example of checking. Continuing in part II they give the theory behind the examples showen in Part I and continue with the algebra analysis. Their papers provide the theorems and the solutions

50. Bizarro, P., L. M. Silva, and J. G. Silva, 1998, "JWarp: a Java library for parallel discrete-event simulations," *Concurrency: Practice and Experience* Volume 10, Issue 11-13, Date: September November 1998, Pages: 999-1005

Bizarro, Silva, and Silve (1998) present Jwarp as a Time Warp PDES control. They describe the advantages and disadvantages of the conservative and optimistic approach for control. Jwarp is a Java based procedure.

51. Bodner, D. A., and L. F. McGinnis. , 2002, "A Structured Approach to Simulation Modeling of Manufacturing Systems," *Proceedings of the 2002 Industrial Engineering Research Conference*, 2002.

Bodner and McGinnis (2002) propose a structured method to develop detailed models of mfg systems. Their method is oriented around using an object oriented approach to create sub-systems which can be combined into the final model. The goal is to reduce model development time.

52. Boesel, J., 1999, "Search and Selection for Large Scale Stochastic Optimization," *PhD dissertation Northwestern University*,

Boesel (1999) presents the application of a modified GA with DES to provide optimization during simulation. Uses GA to search during replicate runs, the GA adjusts the number of replicates to maintain desired error control. After the runs a

separate heuristic approach is used to select optimal results from replicates. Provides comments on problems using GA's over a highly varying solution space (stochastic) versus deterministic spaces, and methods used to control this. During the final best selection the system may recycle into simulation mode to evaluate some promising, but unevaluated areas.

53. Boesel, J., R. O. Bowden, Jr., F. Glover, J. P. Kelly, and E. Westwig, 2001, "Future Of Simulation Optimization," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Boesel, et al. (2001) IS A Panel discussion on using a simulation for optimization. Each panelists presents a position on the topic.

- Royce O. Bowden, an integrated approach as part of general simulation
- Fred Glover and James P. Kelly, major problem is users not aware of possibility
- Erik Westwig, need better tools and/or parallel processing

54. Bois, J. R., 2002, "Decisions within complex systems: An experimental approach using the STRATEGEM-2 computer game," *Ph.D. dissertation State University of New York at Albany*

Bois (2002) is aimed at improving on the performance in the STRATEGEM-2 micro-economic game as developed by Sterman in 1989 for "Misperceptions of Feedback in Dynamic Decision Making". Sterman postulated that poor game performance resulted in a the misperception of the effect of the feedback. Bois proposes that some of the misperception was due to lack of true perfect knowledge and perfect information. He works to show that mixed results by other investigators are form this lack of true perfect knowledge and information. His goal is to improve decisions in a complex system by use of game reinforcement. He concluded that participants did not enjoy true perfect knowledge and perfect information and this is why the misperception about the feedback existed. Bois then show that they can be taught with better instructions to perform better.

55. Braha, D. and Y. Bar-Yam, 2004, Topology of large-scale engineering problem-solving networks, *Physical Review E*, Vol. 69, 2004

Braha and Bar-Yam (2004) identify properties of real world networks of people that compare to biological, informational, and technological networks. These include sparseness, small world, and scaling regimes. This properties help in defining how a real world structure works and compares a system to real people,

56. Brooks, R.J. and A. M. Tobias, 1996, Choosing the best model: level of detail, complexity and model performance, *Mathematical and Computer Modelling*, 24(4), 1-14.

Books and Tobias (1996) proposes a method to define the best model for a task based on desired qualities. They consider model performance and how it relates to the level of detail and the complexity of the model. They recommend using a quantitative assessment method, and considering simplification and alternative

models. They recognize that 9 as of 1996) more study of the quantifiable results is needed.

57. Brunner, D.T., H.J. Yazici and G.R. Baiden, 1999, “Simulating Development In An Underground Hardrock Mine,” *Preprint 99-138 Society for Mining, Metallurgy and Exploration Annual Meeting*, Denver, Colorado, 1999

Brunner, Yazici and Baiden (1999) describe the development of a production sequence analysis using a DES. The model was an integration of several separate software programs to achieve a single system. The basic model was developed using Automod for data management and AutoCAD for visualization, it also included DataMine for historical data..

58. Buchholz, P., 2000, “A hybrid analysis approach for finite-capacity queues with general inputs and phase type service,” *Queueing Systems*, Volume 35 Issue 1-4: pp 167-183, 2000

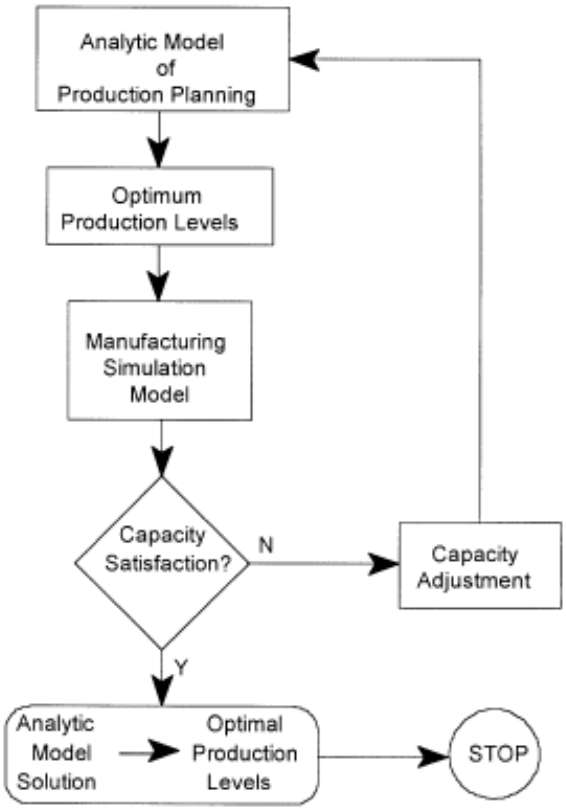
Buchholtz (2000) presents a combination of DES and mathematical programming. Instead of using the MP for higher level analysis it is used for stochastic purposes. The application is shown using servers and queues. The DES is used for calculation of the interarrival function and continuous time Markov chains (MTMC) are used for the service function. The DES simulation keeps the queue populated while the CTMC handles the actual server function.

59. Byrne, M. D. and M. A. Bakir, 1999, "Production planning using a hybrid simulation-analytical approach," *International Journal of Production Economics* Volume 59, Issues 1-3, March 1999, Pages 305-311

Byrne and Bakir (1999) present a system that iterates around a linear programming model interfaced with a DES (SIMAN). Their hybrid solution process is as follows:

Step 1. Generate optimum production plan by the LP model
Step 2. Assign optimum production plan from LP model as input to the simulation model
Step 3. Run simulation model subject to operational criteria
Step 4. Check capacity constraints: if capacity permits go to step 7 if capacity does not permit go to step 5
Step 5. Calculate adjusted capacity
Step 6. Go to step 1
Step 7. Generate production schedule for shop floor based on generated unit load size
Step 8. Stop

This is show graphically as:



Following the work described by Shanthikumar and Sargent (1983) this would be a type V system.

60. Byrne, M.D. and M.M. Hossain, 2005, "Production planning: An improved hybrid approach," *International Journal of Production Economics* Volumes 93-94, 8 January 2005, Pages 225-229 (Proceedings of the Twelfth International Symposium on Inventories)

Byrne and Hossain (2005) continue the work of Byrne and Bakir (1999), and Kim and Kim (2001) using a different LP formulation present a system that iterates around a linear programming model interfaced with a DES (AutoMod). They use the same hybrid solution process as described in Byrne and Bakir (1999).

61. Carullo, L., A. Furfaro, L. Nigro and F. Pupo, 2003, "Modelling and simulation of complex systems using TPN Designer," *Simulation Modelling Practice and Theory* Volume 11, Issues 7-8, 15 December 2003, Pages 503-532

Carullo, et al. (2003) describe the use of TPN Designer for creating and running timed Petri nets. Following an overview of Petri nets and timed Petri Nets, they presents TPN Designer and describe how TPN Designer is organized and used. They also give examples of how TPN Designer is used

62. Cassel, R. A. and M. Pidd, 2001, "Distributed discrete event simulation using the three-phase approach and Java," *Simulation Practice and Theory*, Volume 8, Issues 6-7, 15 March 2001, Pages 491-507

Cassel and Pidd (2001) present a method for achieving PDES using standard PC's, the Internet and JAVA. They use a 3-phase approach instead of the more common 2-phase

- Move to next scheduled time
- Execute all events at that time
- check to see if other events can now be executed

Following an overview of PDES, they describe using distributed PC's using TCP/IP (include an overview of Java). They describe how system would work using phone system example

63. Castillo, I. And C. A. Roberts, 2001, "Real-time control/scheduling for multi-purpose batch plants," *Computers & Industrial Engineering*, Volume 41, Issue 2, November 2001, Pages 211-225

Castillo and Roberts (2001) present using DES (Timed Petri Nets (TPN) to optimize batch chemical plant operation. Based on a typical plant circuit and typical plant scheduling (from literature) they motivates an algorithm and present an example using TPN.

64. Cavalieri, S. and P. Gaiardelli, 1998, "Hybrid genetic algorithms for a multiple-objective scheduling," *Journal of Intelligent Manufacturing* (1998) 9, 361 ± 367

Cavalieri and Gaiardelli, (1998) present the application of hybrid adaptive GA's for scheduling. The GA's are combined with a DES to determine the results. The GA feeds the simulation and analyzes the results. One version also includes a dispatching rule between the GA and the DES input. They compare the two GA approaches with earlier non-adaptive approaches and report that their approach worked better.

65. Cellier, F. E., 1979, "Combined Continuous/Discret System simulation by use of Digital Computers", *DTS dissertation (thesis) Swiss Federal Insiture of Technology (Zurich)*

Cellier (1979) in his dissertation, describes techniques for simulating systems with complex structures by use of a digital computer, as well as the requirements of tools (simulation languages) to cope with the problem in a user-friendly way. He describes three (3) classes of simulation problems

(i) continuous time systems described by ordinary differential equations
(ii) continuous time systems described by partial differential equations
(iii) discrete time systems described by difference equations, sequence of time events or by mixtures of both

For type i and ii, modeling languages have been available for some time, but (at the time of this paper) type ii models are still difficult, he comments that many problems are truly combined i & iii. He then proposes a structure of an SPL to handle combined type I & iii.

(a) a discrete part consisting of elements from known discrete event simulation
(b) a continuous part consisting of elements from known continuous system simulation

(c) an interface part describing the conditions when to switch from (a) to (b) and vice-versa

Cellier then describes the conditions and characteristics for part (c). His proposed system is esstentially an executive program that manages the activities of a DES and a continuous simulator and keeps track of which one should function next.

66. Chan, W. K. and L. W. Schruben, 2003, "Properties Of Discrete Event Systems From Their Mathematical Programming Representations," *Proceedings of the 2003 Winter Simulation Conference* S. Chick, P. J. Sá nchez, D. Ferrin, and D. J. Morrice, eds.

Chan and Schruben (2003) present the use of discrete event simulations for linear programming applications. They describe the use of event graph DES for mathematical programming and show using SIGMA for solving the dual of an LP problem.

67. Chan, W. K. and L. W. Schruben, 2004, "Generating Scheduling Constraints For *Discrete Event Dynamic Systems*," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Chan and Schruben (2004) discuss the use of simulation systems for production scheduling. (Builds on article by Pederson and Trout 2002). They describes the use of a DES (SIGMA) for scheduling production of a Semi-conductor wafer fab machine (cluster tool). They present the use of event graphs simulation as an alternative to mixed integer and mathematical programming. They use the simulation to optimize the production scheduling.

68. Chen, E. J., Y. M. Lee and P. L. Selikson, 2000, "A simulation study of logistics activities in a chemical plant," *Simulation Modelling Practice and Theory* Volume 10, Issues 3-4, 15 November 2002, Pages 235-245

Chen, Lee and Selikson (2000) describe the development of a semi-hybrid model of a chemical processing facility. The system modeled is the storage and shipping side (from plant to storage to shipment). They use emPlant with a unit size of 2 tonnes to provide a semi-continuous system. Experiments were conducted using different numbers and sizes of silos. The Des was used to look at what size and number of silos would provide best results.

69. Chen, M.-C. and T. Yang, 2002, "Design of manufacturing systems by a hybrid approach with neural network metamodelling and stochastic local search," International Journal of Production Research, 1/10/2002, Vol. 40 Issue 1, p71-92, 22p,

Chen and Yang (2002) describe metamodelling as taking a simulation model and then using the inputs and outputs to provide a regression analyis. This is then used for a neural network analysis followed by simulated annealing analysis of these results. Their approach starts with a DES of a manufacturing system, take this output through regression analysis to form the metamodel. Then using the metamodel with neural networks to reach an optimal solution and then uses this

as input for further DES replicates. Then the final results are searched using simulated annealing (SA), to obtain an optimal point. They present an example of their approach on a typical manufacturing system. (Note this would be a combined type III and IV (Shanthikumar and Sargent (1983)) approach.) System assumes that minor changes to inputs do not cause major output changes.

70. Cheng, T.-M. and C.-W. Feng, 2003, "An effective simulation mechanism for construction operations," *Automation in Construction* Volume 12, Issue 3, May 2003, Pages 227-244

Cheng and Feng (2003) show the use of Genetic Algorithms with DES for schedule optimization in construction. They describe how they interfaced the DES (CYCLONE) with GA's and then present two examples of how they interfaced the two.

71. Cheng, T.-M., C.-W. Feng and Y.-L. Chen , 2005, "A hybrid mechanism for optimizing construction simulation models," *Automation in Construction*, Volume 14, Issue 1, January 2005, Pages 85-98

Cheng, Feng and Chen (2005) present the interrelation of stochastic processes with a DES. They use a heuristic or genetic algorithm to provide input to a DES. They provide a method to perform the analysis and show how several runs are performed to determine optimal configuration.

72. Chick, S. E., 2001, "Input Distribution Selection For Simulation Experiments: Accounting For Input Uncertainty.," *Operations Research*, Sep/Oct2001, Vol. 49 Issue 5, p744, 15p;

Chick (2001) discusses problems in selecting the distribution for stochastic analysis during a simulation. He presents that problems with stochastic analysis due to uncertainty in the distribution have been reported in literature and proposes using Bayesian Model Average approach to describe uncertainty due to input uncertainty and stochastic effects. He provides several examples for how it would function and proposes that it is valid both a posterior and a priora.

73. Chignell, M. H., 1990, "A taxonomy of user interface terminology," ACM SIGCHI Bulletin, Volume 21 Issue 4, Apr-90

Chignell (1990) presents a taxonomy for UI technology.

The four main branches (categories of terms) of his taxonomy are:

- The Basic Interface Model
- Cognitive Engineering
- User Interface Engineering
- Human-Computer Interaction Applications

Each of these has sub-area, and sub-sub-areas.

The first branch (Basic Interface Model) reflects the view that the user interface is composed of the seven fundamental components:

- Actions
- Behaviours
- Contexts

- Displays
- Effects
- Forms
- Goals

The second branch of the tree (Cognitive Engineering) refers to the process of applying the models and findings of cognitive science to the task of analyzing and designing user interfaces . The cognitive branch has three sub-area:

- Cognitive Science
- Normative Models
- Descriptive Model s

Interface Engineering is the portion of the research taxonomy which deals with guidelines an d approaches for interface design (engineering). The six areas of interface engineering are:

- General Guidelines
- Interface Structuring
- Interface Training
- Interface Evaluation
- User Interface Development Systems and Tool s
- Interface Engineering Technique s

Application areas that have received attention from researchers in human-computer interaction include :

- Real Time Applications
- Information Technology
- Advanced Programming
- Manufacturing and Industr y
- Computer Assisted Learning

74. Chiplunkar, C., S. G. Deshmukh, and R. Chattopadhyay , 2003, Application of principles of event related open systems to business process reengineering, *Computers and Industrial Engineering*, Volume 45 , Issue 3 Pages: 347 - 374

Chiplunkar, Deshmukh, and Chattopadhyay (2003) use event diagrams for developing a business process reengineering model. From here propose modeling to evaluate the optimum version.

75. Chun, H. W. 1997, “Automatic simulation program synthesis using a knowledge-based approach,” *Simulation Practice and Theory*, Volume 5, Issue 6, 15 August 1997, Pages 473-488

Chun (1997) presents the development of a hybrid simulation system based on SIMAN that uses a rule based approach to generate a simulation model. This is a knowledge based simulation system that generates a new model based on the input to the GUI front end and incorporated rules. The system is queue server system (airport check in counter). The user inputs details about the flight and the system then develops a model and reports the results. It is specific to airport check in and would need modification of rules for other applications.

76. Clymer, J. R., 1995, "System design and evaluation using discrete event simulation with AI," European Journal of Operational Research, Volume 84, Issue 1, 7 July 1995, Pages 213-225

Clymer (1995) presents the use of a DES in complex systems as an AI function. He presents its use in a train scheduling scenario and shows rule learning. He describes his Operational Evaluation Modeling (OpEM) system and contrasts it with classifier system, neural networks, and case based reasoning. He ends with a description of a system with a higher level supervisor to further automate the decision process.

77. Clymer, J. R., 1999a, "Simulation Based Engineering of Complex Adaptive Systems," Simulation, Journal of the Society of Computer Simulation, San Diego, CA, Volume 72, Number 4, April 1999 issue, pages 250-260.

Clymer (1999a) presents the use of Operational Evaluation Modeling for (OpEM) Context-Sensitive System (CSS) OpEMCSS for complex systems. He describes complex systems as case sensitive systems and how OpEMCSS would be used. He uses an example of a two system operation with subtasks. Paper is general overview of OpEMCSS and its interface in EXTEND (Imagine That Inc.).

78. Clymer, J. R., 1999b, "Optimization of Simulated Systems Effectiveness using Evolutionary Algorithms," Simulation, Journal of the Society of Computer Simulation, San Diego, CA, Volume 73, Number 6, December 1999, pages 334-340.

Clymer (1999b) presents the use of an evolutionary algorithm in Operational Evaluation Modeling for (OpEM) Context-Sensitive System (CSS) OpEMCSS. He presents an example for an inventory system where by establishing the DES attributes (THRESHOLD and LOTSIZE) and comparing them to established measures of effectiveness (MOE) the DES can function in an AI mode.

79. Clymer, J. R., 2002, “Simulation-Based Engineering Of Complex Systems Using EXTEND+MFG+OPEMCSS,” *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Clymer (2002) describes a modeling and simulation tool called Operational Evaluation Modeling for Context Sensitive Systems (OpEMCSS) for complex systems. His approach is to use a method of evaluating the system (CSS) and then using (OpEM) to create a hybrid DES model of the system.

80. Colajanni, M., A. Dell'Arte and B. Ciciani, 1998, “Performance evaluation of message passing strategies and routing policies in multicomputers,” *Simulation Practice and Theory*, Volume 6, Issue 4, 15 May 1998, Pages 369-385M.

Colajanni, Dell'Arte and Ciciani (1998) describe a message passing strategy for PDES. They show an implementation in a modular simulator, INTNETSIM designed for modeling interconnected networks

81. Contreras, L. R., C. Modi, and A. Pennathur, 2002, “Integrating Simulation Modeling And Equipment Condition Diagnostics For Predictive Maintenance

Strategies –A Case Study," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Contreras, et al. (2002) provide a case study of using simulation for reliability. They present the use of a DES for evaluating alternative maintenance practices for a garment distribution facility in New Mexico. Data was collected and analyzed to determine the reliability of motors on the conveyor system. Two models developed one using existing practice (preventative maintenance) and one using a predictive maintenance (simulation) approach. Predictive Maintenance produced better results. They used ARENA to develop the models with failure modes.

82. Conwell, C. L., R. Enright, and M. A. Stutzman, 2000, "Capability Maturity Models Support of Modeling and Simulation Verification, Validation, and Accreditation," *Proceedings of the 2000 Winter Simulation Conference*, J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds.,pp. 819-828, December 10-13, 2000

Conwell, Enright, and Stutzman (2000) describe by the use of Capability maturity Models to perform V&V on existing simulation models, this was based on DOD projects. They presents the situation of poorly documented simulation models and the need to determine their reliability. Defines V&V for this scope and how use of the Carnegie Mellon University CMM approach can be used.

83. Cowie, J., 1998, "JTED: parallel discrete-event simulation in Java," *Concurrency: Practice and Experience* Volume 10, Issue 11-13, Date: September November 1998, Pages: 993-997

Cowie (1998) provides a description of the Georgia Tech Java based Time Warp PDES system. Includes a description of its application and how it is based on the Georgia Tech TeD system.

84. Crowley, D. J., J. F. Bard and P. A. Jensen, 1995, "Using flow ratio analysis and discrete event simulation to design a medium volume production facility," *Computers & Industrial Engineering* Volume 28, Issue 2, April 1995, Pages 379-397

Crowley, Bard and Jensen (1995) presents the use of a DES (SLAM II) in the design of a PCB manufacturing system. They describes the basic process and how the model was developed. They provide the simulation results and analysis.

85. Cuena, J. and M. Molina, 2000, "The role of knowledge modelling techniques in software development: a general approach based on a knowledge management tool," *International Journal of Human-Computer Studies*., Volume 52 , Issue 3 (March 2000) Pages: 385 - 421 ,

Cuena and Molina (2000) describe the use of a knowledge management system (KSM) with a system (CONCEL) to create a ontological level description of a model. And then using a conversion system (LINK) to creat the actual model. They present an integrated DSS using real world data connected to a knoweldge base, they verify results using a simulation feature to predict future results.

86. Cuske, C., T. Dickopp and S. Seedorf, 2005, "JOntoRisk: An Ontology-based Platform for Knowledge-based Simulation Modeling in Financial Risk Management", *19TH European Conference On Modelling And Simulation* (European Simulation and Modeling Conference 2005)

Cuske, Dickopp and Seedorf (2005) present JOntoRisk as an ontology based system for risk management. They propose the use of an ontology based knowledge management system to create simulation models for risk management (banking). In their system the ontology is a layered approach to cover meta risk, domain risk, and others. The ontology-based approach may increase automation in simulation engineering. A major challenge in simulation use is the task of bringing together the domain-specific knowledge with the technical skills required for the implementation.

87. Dabbas, R. M., H.-N. Chen, J. W. Fowler and D. Skunk, 2001, "A combined dispatching criteria approach to schedualing semiconductor manfacturing systems," *Computers & Industrial Engineering* Vol. 39, pp. 307-324, 2001

Dabbas, et. Al. (2001) present a weighted average dispatching criteria using different algorithms to improve through put. The method is tested using a DES

88. Dahal, K. P., S. J. Galloway, G. M. Burt, J. R. McDonald, and I. Hopkins, 2005, "A case study of process facility optimization using discrete event simulation and genetic algorithm," Proceedings of the 2005 conference on Genetic and evolutionary computation Washington DC, USA Pages: 2197 - 2198

Dahal, et al. (2005) present a decision support system that combines an expert system (using GA's) with a discrete event model. The study is based on an bulk material handling port system. The DES models the port and mataerial handling system, with the GA component evaluating the results to select optimization points.

89. Dallery, Y. and Y. Frein, 1993, "On decomposition methods for tandem queueing networks with blocking," *Operations Research*, Mar/Apr93, Vol. 41 Issue 2, p386,

Dallery and Frein (1993) provide the analysis of different types of blocking and the impact on the model accuracy.

Blocking after service (Type 1)

Blocking before service (type 2)

They presents examples of each type and their impact

90. Darcan, O. and A. R. Kaylan, 2000, "Load balanced implementation of standard clock method," *Simulation Practice and Theory*, Volume 8, Issues 3-4, 15 September 2000, Pages 177-199

Darcan and Kaylan (2000) compare static and dynamic load balancing for PDES. They describe the problems in achieving PDES using Standard Clock approach using Unix workstations.

91. Darmont, J., 2000, “DESP-C++: a discrete-event simulation package for C++,” *Software: Practice and Experience* Volume 30, Issue 1, Date: January 2000, Pages: 37-60

Darmont (2000) presents a C++ based object oriented DES package. The system is based on a resource view simulation engine. He describes the structure of the engine and gives three examples of its use.

92. Dassisti, D. and L. M. Galantucci, 2005, "Pseudo-fuzzy discrete-event simulation for on-line production control," Computers & Industrial Engineering, Volume 49, Issue 2, September 2005, Pages 266-286

Dassisti and Galantucci (2005) present the use of standard DES (EM-Plant) to perform fuzzy simulations in an on-line environment. Goal was to use the DES for on-line control of a FMS. They use two sets of numbers in botha correlted (both sets the same) and an un-correlated (each different) manne. A tranmission assembly operation was used as a test case. Part of the input to the simulator is a factor called machine efficiency facotr that was set as a fuzzy set and modified for each of 10 replicate runs at each point. When in the uncorrelated mode, the number of runs needed grew large.

93. Dawood, N. and R. Marasini, 2003, “Visualization of a stockyard layout simulator "SimStock": a case study in precast concrete products industry,” *Automation in Construction* Volume 12, Issue 2, March 2003, Pages 113-122

Dawood and Marasini (2003) present an integrated DES CAD system for managing a precast cement storage facility. They describe how AutoCAD and ARENA were interfaced to improve visualazation of alternative facility layouts.

94. De Almeida, D. and P. Kellert, 2000, “An Analytical Queueing Network Model for Flexible Manufacturing Systems with a Discrete Handling Device and Transfer Blockings,” *International Journal of Flexible Manufacturing Systems*, volume 12 issue 1: pp25-57, February 2000

De Almeida and Kellert (2000) present the use of analytical queuing networks. They propose treating an FMS with a single material handling system as a queuing network. They describe why a queuing network approach may be better than others for analyzing FMS systems with a single material handling system. In particular the propose that the queue approach (resource sharing) is superior to the more common transactional approach (Their communicative and transactional concept appear to correlate to Roeder (2004) comparison of resource driven vs. job driven and lead to an event scheduling approach). They treat the actual processes as continuous functions and then use approximations to simulate the continuous functions.

95. De Swaan Arons, H. and C. A. Boer, 2001, “Storage and retrieval of discrete-event simulation models,” *Simulation Practice and Theory*, Volume 8, Issue 8, 15 July 2001, Pages 555-576

De Swaan Arons and Boer (2001) propose creating a rational database of existing DES models for reuse to improve reusability. Their description is based

on Arena. The use a method of parameterization, and then describe how to design and setup the database. And then use the DB to retrieve models.

96. Debuse, J. C. W., V. J. Rayward-Smith and G. D. Smith, 1999, “Parameter optimisation for a discrete event simulator,” *Computers & Industrial Engineering*, Volume 37, Issues 1-2, October 1999, Pages 181-184

Debuse, Rayward-Smith and Smith (1999) present the use of simulated annealing as an optimization algorithm for DES. They compare the results when used with Witness against ProModel and its built in optimizer. They describe Reactive Thermostatically Search as a variation on simulated annealing. They also discuss some problems with the built in ProModel optimizer (need to be careful in how replicates are run). They proposes that their method is more robust.

97. Dejong, C. D. and T. Jefferson, 1999, “Modeling Lot Routing Software Through Discrete-Event Simulation,” *Proceedings of the 1999 Winter Simulation Conference* P. A. Farrington, H. B. Nembhard, D. T. Sturrock, and G. W. Evans, eds.

Dejong and Jefferson (1999) present the development of add-on tools for DES to improve handling of material movement. They use simulation to schedule material handling movement., and as production gets higher, material routing gets more complex, and exiting simulation tools become inefficient. They have developed a new algorithm improve the performance. They also describes the methodology of application, and some of the outcomes.

98. Defense Modeling and Simulation Office, Online M&S Glossary (DoD 5000.59-M). https://www.dmso.mil/public/resources/glossary/results?do=get&def=255

99. Di Febbraro, A., V. Recagno and S. Sacone, 1996, “INTRANET: A new simulation tool for intermodal transportation systems,” *Simulation Practice and Theory*, Volume 4, Issue 1, 15 March 1996, Pages 47-64

Di Febbraro, Recagno and Sacone (1996) present the transportation simulation package INTRANET. They provide an example of how to use it. INTRANET appears to be a TPN system.

100. DiLeo, J. J., 2005, "FreeSML: Delivering On The Open-Source Simulation Language Promise" *Proceedings of the 2005 Winter Simulation Conference M. E. Kuhl, N. M. Steiger, F. B. Armstrong, and J. A. Joines, eds.*

DiLeo (2005) proposes a new method for determining the next event to be run. He created a SPL called FreeSML, which is a Java-based simulation language, providing support for process-oriented and event-oriented simulation, along with limited support for continuous-variable simulation. He utilizes priority queues where the ordering of entries would be automatically updated, based on the current priorities reported by the queue’s elements.

101. DiLeo, J. J., 2005, "Discrete-event simulation with state-dependent and stochastic process priorities", *D.Sc. dissertation The George Washington University*,

DiLeo (2005) in his dissertation, proposes a new method for determining the next event to be run. In historical and extant SPL's studied, the ordering of elements in priority queues is determined based on the priority of each element at the time it is added to the queue. Ties normally determined on a FIFO basis. Most SPL's (studied) look primarily at the FEL while some maintain other lists (delayed, etc.). in state-dependent and stochastic DES models the actual priority can change from when an event is placed in the lists for action. He utilizes priority queues where the ordering of entries would be automatically updated, based on the current priorities reported by the queue's elements. He created a SPL called FreeSML, which is a Java-based simulation language, providing support for process-oriented and event-oriented simulation, along with limited support for continuous-variable simulation.

102. Dogan, C. A., T. F. Mcclain and S. A. Wicklund, 1997, "Simulation modeling and analysis of a hardwood sawmill," *Simulation Practice and Theory*, Volume 5, Issue 5, 15 July 1997, Pages 387-403

Dogan, Mcclain, and Wicklund (1997) describe the development of a sawmill simulation in ARENA. They present the initial studies of the sawmill. This is a case study of the use of ARENA.

103. Dogan, M. E., 2007, "Integration of Planning and Scheduling for Batch and Continuous Process Systems," *PhD Dissertation*, Carnegie Mellon University, August 2007

Dogan (2007) in his dissertation presents the use of mixed integer linear programming (MILP) models for solving the planning and scheduling of batch multi-period, multi-product processing facilities. He also analyzes multi-product continuous facilities in a similar manner. He bases his work on the fact that competitive pressures have caused process industries to search for new tools such as Enterprise-wide Optimization (EWO). EWO is about optimizing operations; in particular logistics and manufacturing activities. While EWO does overlap supply chain management, EWO focuses more on planning and scheduling of production. Dogan concentrates his work on batch and continuous multi-period, multiproduct processing facilities. He presents that since time periods are tied together from one period to the next (such as by inventory level variations), this prevents the independent solution of each time period.

104. Dominiak, D. M, 2001, Genetic algorithms for agent evolution and resource exchange in complex adaptive systems*, Ph.D. dissertation Illinois Institute of Technology*

Dominiak (2001) presents the development of ECHO (developed by John Holland of the Santa Fe Institute as a model for artificial life (Echo) that has been used for evaluating CAS applications) software package based on a 3D open source graphics engine. The work extends the basic ECHO system and marries it to a 3D GUI (ECHOSTAR). The main advancement is the GUI engine.

105. Duse, M. N., 1994, Investigation of fast and hybrid modeling approaches for simulation of manufacturing systems, *Ph.D. dissertation Oklahoma State University*,, Duse (1994) presents a method to combine a fast (no event list) simulation with a conventional discrete simulation system that has advantages of both (speed of fast & flexibility of discrete). His goal is to develop system capable of system control for flexible manufacturing. He proposes that hybrid (defined as fast/discrete) approach can improve execution speed.

106. Evans, G., and S. Alexander, 2007, "Using Multicriteria Modeling and Simulation to Achieve Lean Goals," *Proceedings of the 2007 Winter Simulation Conference*, S. G. Henderson, B. Biller, M.-H. Hsieh, J. Shortle, J. D. Tew, and R. R. Barton, eds.
Evans and Alexander (2007) present the use of an analytical approach (Shanthikumar and Sargent (1983) Type III (a simulation model is used to feed an analytical model)) to solving multicriteria problems for lean manufacturing support. They describe how to select the factors for the analytical portion and how to evaluate them. They apply their concept to an example of distribution system for a manufacturer. They state that this method conforms to basic lean principles and by using this hybrid approach can be attained.

107. Feldman, P., A. Muni and G. Swindle, 1997, "An optimal termination testing procedure for discrete event simulations," *Mathematics and Computers in Simulation* Volume 44, Issue 1, May 1997, Pages 81-98
Feldman, Muni and Swindle (1997) describe a method for checking for termination condition in a DES with minimal CPU costs. They define some conditions that require checking for termination conditions
(i) defined run time no problem
(ii) minimum frequency of occurrence frequent testing can be increase run time
(iii) special even or condition frequent testing can be increase run time
They present some examples where the above can occur
- Systems with unreliable components
- Air defense system
- Computer chess match

They apply statistical analysis to determine the time intervals for checking for termination conditions. The potential for decreasing run time costs by decreasing the number of too early tests.

108. Fioroni, M., L. Franzese, E. Harano, J. Lima, J. Mendes, J. Cuzzuol, R. Santos, R. Coelho, B. Costhek, and A. Silva, 2005, "Simulation Based Decision for Steelmaking Operations Challenges," *Proceedings of the 2005 Winter Simulation Conference M. E. Kuhl, N. M. Steiger, F. B. Armstrong, and J. A. Joines, eds.*
Fioroni, et al. (2005) present the use of CST Steel Making simulator based on Arena. CST Steel making models an integrated steel process.

109. Fioroni, M., L. Franzese, J. Furia, L. de Toledo Perfetti, D. Leonardo, N. Laudelino da Silva, and C. Zanin, 2007, "Simulation of Continuous Behavior Using

Discrete Tools: Ore Conveyor Transport," *Proceedings of the 2007 Winter Simulation Conference*, S. G. Henderson, B. Biller, M.-H. Hsieh, J. Shortle, J. D. Tew, and R. R. Barton, eds.

Fioroni, et al. (2007) identified that bulk material handling systems are a mixture of discrete and continuous operations, and that the modeling of such a system is a challenge for model builders. They present alternative methods to model continuous behavior as small packets of discrete events. They conclude that his works for systems which have "discrete to continuous" and also "continuous to discrete" behavior.

110. Fishwick,, P.A. and J.A. Miller, 2004, Ontologies for Modeling and Simulation: Issues and Approaches, *Winter Simulation Conference*, 2004. Proceedings of the 2004 Winter, Volume 2, 5-8 Dec. 2004 Volume: 1, On page(s): - 264

Fishwick and Miller (2004) describe the application of ontologies as developed at University of Florida (Fishwick) and University of Georgia (Miller) for simulation and modeling. In particular they are orienting their presentation to internet based approaches. Starting with a diagrammatic ontology showing the relation of types of Petri nets, they then describe their individual work. Fishwick describes RUBE and Miller describes OWL and SWRL and DeMO. Paper is an overview of work some of which is described in Miller, et al. (2004).

111. Flatto, J. and L. L. Gardner, 2000, "Using Information Generated By A Discrete Event Simulation To Evaluate Real Options In A Research And Development Environment," *Proceedings of the 2000 Winter Simulation Conference*, J. A. Joines, R. R. Barton, K. Kang, And P. A. Fishwick, Eds.

Flatto and Gardener (2000) examines the use of a discrete event simulation (DES) software (Extend) in planning a research and development project. Tjhey calculate both the critical path and the net present value of alternative projects using the DES. The paper provides an example for evaluating 25 projects using both a deterministic and a stochastic approach.

112. Fonseca, D. J., 1998, "A Knowledge Based System For Reliability Centered Maintenance in the Chemical Industry," *dissertation Louisiana State University*

Fonseca (1998) propose a reliability centered maintenace (RCM) system that reads real-time operating data via Aspen Tech and ouputs an RCM list for evaluation. Current data is compared to the rule base to generate the RCM documents.

113. Fonseca, D.J. and G. M. Knapp, 2000, "An expert system for reliability centered maintenance in the chemical industry, " Expert Systems with Applications, Volume 19, Number 1, July 2000, pp. 45-57(13)

Fonseca and Knapp (2000) propose a reliability centered maintenace (RCM) system that reads real-time operating data via Aspen Tech and ouputs an RCM list for evaluation. Current data is compared to the rule base to generate the RCM documents. Paper is based on work for Fonseca's dissertation under Knapp.

114. Fonseca, D., G. Uppal, and T. Greene, 2004, “A Knowledge-based System for Conveyor Equipment Selection,” *Expert Systems With Applications*, Volume 26, Issue 4, May 2004, Pages 615-623

Fonseca, Uppal, and Greene (2004) present a DSS for selecting conveyor equipment. The system is oriented towards system selection based on general criteria. They iodentify that the tradtional method has been to leave the selection to process engineers, who may or mya not have specific exeprience in the required type of conveying application. They identified eight (8) previous effrts to automate the conveying system selection. Their system combines most of these with additional prefernce based criteria. Initially they separate the selection by general type; unit conveying, bulk material handling, or sorting conveyors. Each of these has specific selection criteria to further define the system. The ouitput ranks the recommendations based on derived suitability scores.

115. Fosset, C.A., D. Harrison, H. Winthrop and S. I. Gass, 1991, “An assessment procedure for simulation models: a case study”, Operations Research, 39(5), 710-723, 4 citations

Fosset,. Harrison, Winthrop, and Gass, (1991) presents the GAO's guidelines for assessing simulation models from a general perspective. This paper is part of the set of papers presenting the GAO's work on VV&A. The authors present information showing that the US Government is a major user of computer models. They hold that the exact number of models is unknown, but estimated in the tens of thousands. The GAO estimated that in 1980 the DoD spent over $250 million on quantitative studies. Their position is that a portion of this expense is wasted on little used models. This is caused by not following a verification and validation procedure and by not providing complete documentation.

116. Franck, B. M., 1989, “Qualitative engineering at various levels of conception design and evaluation of structures,” *Proceedings of the 2nd international conference on Industrial and engineering applications of artificial intelligence and expert systems* - Volume 1 IEA/AIE '89, Jun-89

Franck (1989) proposes the development of a multilayered framework for an AI based knowledge system. This system is to be the basis for knowledge based expert system. The system includes attempt to mimic autopieses aspects.

117. Frantz, F. K., 1995, "A taxonomy of model abstraction techniques," Proceedings of the 27th conference on Winter simulation, Dec-95

Frantz (1995) describes going from a real world system, through a conceptual model to the simulation model as going to increasing levels of abstraction as you are going to simpler levels. A key object is to maintin a validity as you go to increase abstraction. His method is drawn from both simulation and modeling and from artifical intelligence. His work describes how the abstractions are developed based on three primary ways of modification in going from real to model, Under each he sub catagorieses by how you can achieve abstraction.;

- Model Boundary Modification
  - Explicit Assumptions
    - Hierarchies of Models
    - Delimit Input Space
  - Derived Abstractions
    - Approximation
    - Selection by Influences
- Modification of Behaviors
  - State Aggregation
    - Behavior Aggregation
    - Causal Decomposition
    - Aggregation of Cycles
    - Numeric Representation
  - Temporal Aggregation
  - Entity Aggregation
    - By Function
    - By Structure
  - Function
- Modification of Model Form
  - Look-Up Table
  - Probability Distribution
  - Linear Function Interpolation
  - Metamodeling

118. Frimpong, S., E. Asa and R. S. Suglo, 2001, "Numerical Simulation of Surface Mine Production System Using Pit Shell Simulator," *Mineral Resources Engineering* Vol. 10, No. 2 (June 2001)

Frimpong, Asa and Suglo (2001) present a multi-criteria analysis system for open pit mining. The system try's to optimize the production plan based on ore scheduling and cost minimization. While never using the terms, the system looks to be straight forward mathematical programming model with stochastic functions.

119. Frimpong, S. E., G.-K. Er and J. Symanski , 2004, "Computer Simulation and Animation of Large Scale Surface Mining Systems," *Proceedings of the 2004 Summer Computer Simulation Conference*

Frimpong, Er, and Symanski (2004) propose use of an interactive system to enable faster construction of a simulation. They present the concept that problems in quickly developing a simulation inhibit its use. They proposes creation of simulation components to allow faster model creation

120. Fu, M. C. and K. J. Healy, 1997, "Techniques for optimization via simulation: an experimental study on an (s,S) inventory system," *IIE Transactions*, volume 29 issue 3: pp 191-199, 1997

Fu and Healy (1997) compare alternative optimization methods for a hybrid simulation. They use two alternatives:

- gradient-based algorithm
- retrospective approach

Using a basic inventory system the simulation the approaches are compared.

121. Fulbright, R., 2002, "Information domain modeling of emergent phenomena," *Ph.D. dissertation University of South Carolina*

Fulbright (2002) proposes a mechanism where a collection is greater than the sum of its parts for AI and CAS. He calls this emergent capacity. He defines an information domain which allows the modeling and analysis of the emergent capacity. He presents an equation for emergent capacity and shows how it can be used.

122. Gaines, B. R., 1997, "Knowledge Management in Societies of Intelligent Adaptive Agents," *Journal of Intelligent Information Systems*, Volume 9 Issue 3, Nov-97

Gaines (1997) paper deals with how groupings of intelligent adaptive agents share knowledge and this can be modeled. He presents that when dealing with intelligent adaptive agents, studies have shown how they use knowledge, but not how groupings of them share knowledge.

123. Garcia, H. E., 2000, "Operational analysis and improvement of a spent nuclear fuel handling and treatment facility using discrete event simulation," *Computers & Industrial Engineering*, Volume 38, Issue 2, July 2000, Pages 235-249

Garcia (2000) presents a study of nuclear spent fuel processing facility using a DES. He describes the facility and how the simulation model was developed. He discusses some of the results of the analysis, but does not state what DES was used.

124. Gass, S. I., 1983, "Decision Aiding Models: Validation, Assessment, and Related Issues for Policy Analysis", Operations Research, Vol. 31, No.4, Pp. 601-663. 5, citations

Gass's (1983) paper presents a review of how operational research (OR) methodology, and in particular the use of computer modeling can be applied to policy analysis issues (or "squishy" problems). The application of OR methodology, and in particular the use of computer modeling to business and industry was well established by the early 1960's. At that point work began on how to apply the same OR techniques to policy analysis issues (or "squishy" problems). These problems are seldom clear-cut or well defined, as such the use of modeling has not always been successful. Proving the credibility of the model to the users and reviewers (who may have little training in OR) is difficult, as they often have a mental picture of how things work and if the model disagrees with that picture then they assume the model is wrong. To overcome this Gass presents that the use of verification and validation is important.

125. Gaury, E. G. A., H. Pierreval, and J. P. C. Kleijnen, 2000, "An evolutionary approach to select a pull system among Kanban, Conwip and Hybrid," *Journal of Intelligent Manufacturing*, volume 11 issue 2: pp 157-167, April 2000

Gaury, Pierreval, and Kleijen (2000) present an optimization system based on a hybrid approach. They use genetic algorithms and a DES for process control based on alternative control strategy: KanBan, Conwip, and Combined

126. Giacaman, G. J., R. P. Medel and J. A. Tabilo, 2002, "Simulation Of The Material Transporting And Loading Process In Pedro De Valdivia Mine," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Giacaman, Medel, and Tabilo (2002) present the development and validation of DES for an analysis of the material handling system at a copper mine in Chile. The system models the loading of the trucks and haulage to the dump station. It utilizes equipment breakdown scheduling. They presents model development and how data was samples for validation. The system uses GPSS/H

127. Gil, N. and I. D. Tommelein, 2001, "Comparison Of Simulation Modeling Techniques That Use Preemption To Capture Design Uncertainty," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Nuno and Tommelein (2001) compares two alternative models and their approach to preemption on modeling a design process. They present the use of simulation in understanding uncertainty during engineering design. The paper describes two types of simulation approaches

- Event scheduling using Sigma
- Activity scanning using Stroboscope

They explains the importance of preemption in modeling breakdowns and alternative routes to the same goal. They describe the two models created and how they work.

128. Glover, F., J.P. Kelly and M. Laguna, 1999, "New advances for wedding optimization and simulation," *Winter Simulation Conference Proceedings*, 1999. Volume 1, 5-8 Dec. 1999 Page(s):255 - 260 vol.1

Glover, Kelly and Laguna (1999) present some examples of using an integrated set of methods, including Tabu Search, Scatter Search, Mixed Integer Programming, and Neural Networks, combined with simulation. Applications include project portfolio optimization and supply chain management. They use Automod

129. Godding, G., H. Sarjoughian, and K. Kempf, 2007, "Application Of Combined Discrete-Event Simulation And Optimization Models In Semiconductor Enterprise Manufacturing Systems," *Proceedings of the 2007 Winter Simulation Conference*, S. G. Henderson, B. Biller, M.-H. Hsieh, J. Shortle, J. D. Tew, and R. R. Barton, eds.

Gooding, Sarjoughian, and Kempf (2007) state that while it is common to use simulation to validate the results of an analytical schedualing approach, it is not common to integrate the two ("the science of how to rigorously integrate simulation and decision models is not well understood and becomes critically important as the complexity and scale of these models increase"). They

developed a methodology (Knowledge Interchange Broker (KIB)) for integrating different types of models. An example of this system using a semiconductor assembly operation is presented. The system combines the stochastic element and the simulation element with composable components. They plan to expand this to other operations.

130. Graham, K. J. L., 2001, “A complete implementation of John Holland's Echo model for complex adaptive systems,” *MCS thesis Carleton University (Canada)*
Graham (2001) presents an implementation example of the use of Holland of the Santa Fe Institute model for artificial life (Echo) that has been used for evaluating CAS applications. Graham provides a detailed description of the Echo model and then shows an implementation of that model.

131. Greasley, A., 2000, “Using simulation to assess the service reliability of a train maintenance depot,” *Quality and Reliability Engineering International* Volume 16, Issue 3, Date: May/June 2000, Pages: 221-228
Greasley (2000) presents an example of using Arena to schedule the work at a train depot. To evaluate the requirements and capabilities of third party repair facility an ARENA model of the depot was constructed and run.

132. Gruer, P., A. Koukam and B. Mazigh, 1998, “Modeling and quantitative analysis of discrete event systems: A statecharts based approach,” *Simulation Practice and Theory*, Volume 6, Issue 4, 15 May 1998, Pages 397-411
Gruer, Koukam and Mazigh (1998) describe the use of statecharts in modeling and simulation of computer networks. Statecharts appear to be similar to an event scheduling approach. All state changes occur due to an event that can be constrained by conditions. (Note: logic appears similar to Sigma) An example is given of WAN consisting of two (2) LAN's.

133. Gruninger, M., C. Schlenoff, A. Knutilla, and S, Ray, 1997, "Using process requirements as the basis for the creation and evaluation of process ontologies for enterprise modeling," *ACM SIGGROUP Bulletin*, Volume 18 Issue 2, Aug-97
Gruninger, Schlenoff, Knutilla, and Ray (1997) discuss the characteristics of a process language to be used for developing an ontology. They establish that a process has four (4) components; a core, and outer core, extensions, and application specific items. Looking at these as an ontological organization is one approach. In addition they state that processes can be described by:
- grouping of requirements depending on their relationship to resources, tasks, time (the three basic attributes of a process), or some combination of them
- grouping of requirements as primitive concepts, their characteristics, and relationships
- grouping of requirements with respect to their level of granularity as a function of the manufacturing life cycle. Some requirements may only be necessary later in the manufacturing life cycle (when detailed information is required) while others may only be relevant earlier in the life cycle.

They then describe what makes up an ontology and how the above might be used. They do not provide a definitive answer, but refer on to other internal (NSIT) reports.

134. Haas, P.J., 2004, "Stochastic Petri Nets for Modelling and Simulation," *Proceedings of the 2004 Winter Simulation Conference*, 2004.Volume: 1, pp. 95-106
Haas (2004) paper is a tutorial on SPN's. He provides an introduction to SPNs, with an emphasis on those aspects of SPNs that are pertinent to simulation. He provides the theoretical basis and theorems on whihc SPN operate, and information on how they function for DES.

135. Hajjar, D., S. AbouRizk, and K. Mather, 1998, "Integrating Neural Networks With Special Purpose Simulation," *Proceedings of the 1998 Winter Simulation Conference* D.J. Medeiros, E.F. Watson, J.S. Carson and M.S. Manivannan, eds.
Hajjar, AbouRizk, and Mather (1998) describe a procedure for integrating neural network input modeling with DES. They propose using ANN's for developing input for a DES (Type III hybrid). They present the integration of the system with AP2-Earth (a earth moving scheduling DES). They present the process by which they developed the integrated system and the methods they used. An example of large excavator operation is given showing the results.

136. Hao, Q. and W. Shen, 2008, "Implementing a hybrid simulation model for a Kanban-based material handling system," *Robotics and Computer-Integrated Manufacturing*, Volume 24, Issue 5, October 2008, Pages 635-646
Hao and Shen (2008) describe a system for modeling a Kanban based material handling system. While claiming it to be a hybrid system, the description appears to be more a high level DES with continuous components. They present their description stressing the system dynamics approach. They mention that material handling system is often over simplified but can lead to production breakdowns, low efficiency, and low performance of a production system.

137. Hasegawa, A. C., C. M. Gempesaw, W. H. Daniels and B. R. Petrosky, 1999, "Simulating The Economic Viability Of Crawfish Production: A Two-Stage Approach," *Proceedings of the 1999 Winter Simulation Conference*, P. A. Farrington, H. B. Nembhard, D. T. Sturrock, And G. W. Evans, Eds.
Hasegawa, et al. (1999) present a study using a DES (ProModel) simulating alternative economic situations and then using a spreadsheet tool (@Risk) for analysis. They argues for two stage approaches (simulation then analysis) for a stochastic situation.

138. Hazra, M. M., D. J. Morrice and S. K. Park, 1997, "A simulation clock-based solution to the frequency domain experiment indexing problem," *IIE Transaction*, volume 29 issue 9: pp769-782, 1997
Hazra, Morrice, and Park (1997) present the issue of frequency domain experiments, and the selection of the appropriate index value for proper analysis for factor screening. They present three examples of a carefully chosen discrete

oscillation index yielding poor results during the Fourier analysis stage. For these three examples using a discrete FDE oscillation index and associated sampling index is complicated and requires empirical assumptions to be made. After showing these problems they show using a simulation clock time as the basis for the FDE index. They provide similar examples showing how this approach leads to better results.

139. Henderson, S. G. and P. W. Glynn, 1999, "Derandomizing variance estimators," *Operations Research*, Nov/Dec 1999, Vol. 47 Issue 6, p907,

Henderson and Glynn (1999) present the use of "conditioning" to give less randomness to the variance measure from DES analysis. To achieve greater accuracy in point estimates it may be necessary to attempt to de-randomize the results.

140. Henriksen, J. O., 2000, "SLX: The X Is For Extensibility," *Proceedings of the 2000 Winter Simulation Conference* J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds.

Henriksen (2000) presents and overview and a discussion of SLX, a GPSS/H based graphical interface simulation package. He describes the structure of SLX and how it functions.

141. Hidaka, S., T. Aoki, H. Aida, and T. Saito, 2002, "Implementation and performance evaluation of a FIFO queue class library for time warp," *Systems and Computers in Japan* Volume 33, Issue 9, Date: August 2002, Pages: 90-98

Hidaka, et. Al. (2002) presents a specialized library functions for handling FIFO queues in PDES.

142. Hirata, C. and J. Kramer, 1997, "An investigation of the use of world views with shared variables in Time Warp," *Simulation Practice and Theory*, Volume 5, Issue 6, 15 August 1997, Pages 515-533

Hirata and Kramer (1997) describe the use of the Time Warp method in PDES for different world views. They discuss the three main world views and the three phase method and the implementation of Time Warp in each World view in PDES. They then describe two simplified concepts of the alternative methods of sharing information

- philosophers eating
- simple queues

143. Hitt, T. L. D., 1998, "OBSRV/ANN: A block-style hybrid simulation C++ class library," *Ph.D. dissertation The University of Alabama at Birmingham*,,

Hitt (1998) presents the development of a prototyping library (OBSRV) for use with artificial neural networks (ANN) in developing simulation models. According to Hitt some DES packages (Visual-SLAM, SIMSCRIPT, SIMAN, and GGC can have models with discrete and continuous parts. But, they are not necessarily an integrated package. She presents the application of an object oriented C++ system, based on GPSS that can be combined with artificial neural network

components to achieve a true hybrid system. Her system (OBSRV/ANN) is extensible and modifiable due to object oriented design. OBSRV was developed as an object oriented library of class structures to take advantage of the strengths of C++. It was then combined with an ANN subsystem of library classes.

144. Hlupic, V., Z. Irani, and R. J. Paul, 1999, "Evaluation framework for simulation software," *International Journal of Advanced Manufacturing Technology*, 15(5), 366-382.

Hlupic, Irani, and Paul (1999) present a checklist to compare simulation software. Criteria are grouped by;

- general features
- visual aspects
- coding aspects
- efficiancy
- modelling assistance
- testability
- software compatability
- input/output
- experimental features
- statistical facilities
- user support
- finanical and technical features
- pedigree

145. Hochbaum, D. S. and A. Chen, 2000, "Performance Analysis And Best Implementations Of Old And New Algorithms For The Open-Pit Mining Problem," *Operations Research* Volume: 48. November-December 2000, Number: 6. Pgs: 0894-0914

Hochbaum and Chen (2000) present the result of solving a mathematical programming problem based on a genetic algorithm approach for a Decision Support System. They compare alternative algorithms for solving the pit contour problem. Their algorithm (Push-relabel) provides improved design results, but requires more computational resources than the standard LG (Lerchs and Grossmann) algorithm.

146. Hollocks, B. W., 2001, "Discrete-event simulation: an inquiry into user practice," *Simulation Practice and Theory*, Volume 8, Issues 6-7, 15 March 2001, Pages 451-471

Hollocks (2001) is a survey of European users on DES, in which he measured user experience level and use of DES. DES is becoming more commonly used by non-experts. While software development has stressed ease of use and model building for the non-specialist, this may come at a risk of incorrect methodology selection.

147. Horng, H. -C. and J. K. Cochran, 2001, “Project surface regions: a decision support methodology for multitasking workers assignment in JIT systems,” *Computers & Industrial Engineering*, Volume 39, Issues 1-2, February 2001, Pages 159-171

Horning and Cochran (2001) use a response surface methodology with a simulation loop to provide optimization in JIT worker scheduling. As an extension of response surface to the areas just used by the study they define a project surface region. Their goal is to use multi-tasking workers in a near optimal configuration.

148. Huang, S., Y. Hu and C. Li , 2004, “A TCPN based approach to model the coordination in virtual manufacturing organizations,” *Computers & Industrial Engineering*, Volume 47, Issue 1, August 2004, Pages 61-76

Huang, Hu, and Li (2004) present using PN's for analyzing a distributed mfg process in a virtual operation, They describe timed colored petri ntes (TCPN), and describe how to simulate the proposed process using TCPN's.. they present a typical example

149. Hur, S., Y. H. Lee, S. Y. Lim, and M.H. Lee, 2004, “A performance estimation model for AS/RS by M/G/1 queuing system,” *Computers & Industrial Engineering* 46 (2004) 233–241

Hur, et al. (2004) present using a stochastic method to improve accuracy of the simulation of an Automated Storage/Retrieval System (AS/RS) by using queuing theory.

150. Hyden, P., L. Schruben, and T. Roeder., 2001, “Resource Graphs for Modeling Large-Scale, Highly Congested Systems*,” Proceedings of the 2001 Winter Simulation Conference*: 523-529.

Hyden, Schruben, and Roeder (2001) contrast a resource driven model with a job driven model. They present the concept that resources driven models maybe inherently faster than job driven. (Note Schruben and Roeder (2003) builds on this, and goes on to event graph maybe faster). They review the differences between resource driven and job driven and event graph versus process interaction. They compares a resource driven and job driven approach for information generated, and contrast run time of ARENA model to a SIGMA model (SIGMA faster).

151. Ingalls, R. G., 2001, “Introduction to simulation," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Ingalls (2001) part of a continuing series at WSC of An overview of simulation. He uses a drive thru restaurant as an example. He describes how the example would be structured in a typical DES and presents what and how results might be collected and analyzed. He describes how the example system might be refined based on initial results

152. Jacobson, S. H. and E. Yucesan, 1999, “On the complexity of verifying structural properties of discrete event simulation models*,” Operations Research*, May/Jun99, Vol. 47 Issue 3, p476, 6p, 1 chart;

Jacobson and Yucesan (1999) presents the use of complexity theory to assess the likelihood of stalling or other problems.. Following a discussion of general DES terminology, they present complexity theory and show how it can be implemented on a simple problem. The general use would be in V&V.

153. Jianga, Z., M. J. Zuo, R. Y. K. Fungd and P. Y. L. Tue, 2001, “Colored Petri Nets with changeable structures (CPN-CS) and their applications in modeling one-of-a-kind production (OKP) systems,” *Computers & Industrial Engineering*, Volume 41, Issue 3, December 2001, Pages 279-308

Jianga, et al. (2001) propose a method to modify CPN's during execution. They defines CPN's with changeable structures and defines algorithims for change (two types of change).

- Modification
- Composition

They provides an example for a small manufacturing shop. For a multiproduct/varying operation has some potential over trying to create a structure that covers all possible alternatives

154. Jim, H. K. and Z. Y. Chang, 1998, “An airport passenger terminal simulator: A planning and design tool,” *Simulation Practice and Theory*, Volume 6, Issue 4, 15 May 1998,Pages 387-396

Jim and Chang (1998) describe an airport simulator developed in SLAM II.

155. Johansson, B. and J. Kaiser, 2002, “Turn Lost Production Into Profit – Discrete Event Simulation Applied On Resetting Performance In Manufacturing Systems,” *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Johansson and Jürgen (2002) presents the use of a DES (AutoMOD) for operation optimization. The DES is used to improve equipment and manpower utilization. They use a generic manufacturing operation.

156. Joines, J. A., A. B. Sutton, K. Thoney, R. E. King, and T. J. Hodgson, 2003, “Implementing A Simulation-Based Scheduling System For A Two-Plant Operation,” *Proceedings of the 2003 Winter Simulation Conference* S. Chick, P. J. Sánchez, D. Ferrin, and D. J. Morrice, eds.

Joines, et al. (2003) describe the application of Virtual Factory for a scheduling simulation. They describe the processing steps at two separate plants and present the organization of the simulation in VF. They describe how VF is run using external files.

157. Kaminka, G. A., M. M. Veloso, S. Schaffer, C. Sollitto, R. Adobbati, A. N. Marshall, A. Scholer, and S. Tajada, 2002, "GAMEBOTS: A Flexible Test Bed For

Multiagent Team Research," Communications of the ACM, Jan2002, Vol. 45 Issue 1, p43-45,

Kaminka, et al. (2002) present a software tool for creating intelligent agents that interact in a 3D environment. The basic software is an extension to an open source 3D game program (Unreal Tournaments). The AI agents can then interact with real people in a networked environment.

158. Kannan, G., L. Schmitz, and C. Larsen, 2000, "An Industry Perspective On The Role Of Equipment-Based Earthmoving Simulation," *Proceedings of the 2000 Winter Simulation Conference* J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds.

Kannan, Schmitz, and Larsen (2000) present an overview of simulations from a users perspective, particularly from construction (earthmoving). They say that simulation should take owners/users perspective/orientation into account. And that special purpose software is often easier to sell when special knowledge is high or frequency of use is low. Also that the user interface is important in special use or low frequency applications They present and example of how this can be done for construction (earthmoving) industry.

159. Kartam, N. and I. Flood, 2000, "Construction simulation using parallel computing environments," *Automation in Construction* Volume 10, Issue 1, November 2000, Pages 69-78

Kartam and Flood (2000) review alternative methods to achieve hybrid performance for DES in a construction environment. They provides a good overview of:

- Serial-algorithmic processing
- Parallel-algorithmic processing
- Simulation program level parallelism
- Model component level parallelism
- Neural network based simulation
- Functional neural computing
- Recursive neural computing

They provide some examples using an excavation project.

160. Kasputis, S., and H.C. Ng, 2000, "Composable Simulations," *Proceedings of the 2000 Winter Simulation Conference* J. A. Joines, R. R. Barton, K. Kang, and P. A. Fishwick, eds. pp 1577 1584

Kasputis and Ng (2000) propose a framework to achieve simulation reuse

- a system where the user at runtime can create a simulation
- maximize reuse of previous work

They hold that existing simulations are not designed for reuse and to enable reuse, simulations need to be designed for it.

161. Kelton, W. D., 1999, "Designing Simulation Experiments.," *Proceedings of the 1999 Winter Simulation Conference*, ed. P. A. Farrington, H. B. Nembhard, D. T. Sturrock, and G. W. Evans.

Kelton (1999) presents an introductory overview to designing simulation experiments. He presents the concept that performing simulation experiments should be treated the same as running physical experiments. He describes the use of random numbers to achieve repeatability, and describes standard experiments design (see Montgomery text) for establishing the simulation experiment. One difference with physical experiments is that you have control over un-controllable factors.

162. Kelton, W. D., 2001, "Some Modest Proposals for Simulation Software- Design and Analysis of Experiments," *Proceedings of the 34th Annual Simulation Symposium (SS01)* Page: 3 2001

Kelton (2001) discusses that current simulation software packages, while using advanced simulation methods have not included statistical analysis advances. His paper discusses a variety of design-and-analysis capabilities that he feels should be as available and as easy-to use as are current modeling and graphics functions.

- Input analysis
- Random-number generators (see L'Ecuyer, P., 1996, "Combined Multiple Recursive Random Number Generators", review)
- Variate and process generation
- Statistical analysis of a single system
- Comparison, selection, and ranking of several given systems
- Variance reduction
- Sensitivity and gradient estimation
- Experimental design
- Optimum seeking

163. Kelton, W., R. P. Sadowski, and D. T. Sturrock. 2004. Simulation with Arena. 3rd Edition, McGraw Hill.

Kelton, Sadowski, and Sturrock. (2004) in Simulation with Arena stated that in a continuous model, the state of the system can change continuously over time and that in a discrete model, the change can occur only at separated points in time.

164. Kendall, D.G., 1953, "Stochastic Process Occurring in the theory of Queues and Their analysis by the Method of Imbedded Markov chains," *Annals of mathematical Statistics*, Vol 24 pp 338-354

Kendall (1953) is an early work on the stochastic nature of queues. Early use of queue notation now referred to as Kendall's notation. There is a standard notation for classifying queueing systems into different types. This was proposed by D. G. Kendall. Systems are described by the notation:

A / **B** / **C** / **D** / **E**

where:

A	Distribution of interarrival times of customers
B	Distribution of service times

C	Number of servers
D	Maximum total number of customers which can be accommodated in system
E	Calling population size

A and **B** can take any of following distribution types:

M	Exponential Distribution (Markovian)
D	Degenerate (or Deterministic) Distribution
E_k	Erlang Distribution (k = shape parameter)
G	General Distribution (arbitrary distribution)

Notes: If G is used for **A**, it it sometimes written GI. **C** is normally taken to be either 1, or a variable, such as n or m. **D** is usually infinite or a variable, as is **E**. If **D** or **E** are assumed to be infinite for modelling purposes, they can be omitted from the notation (which they frequently are). If **E** is included, **D** must be, to ensure that one is not confused between the two, but an infinity symbol is allowed for **D**.

Examples

- D / M / *n* - This would describe a queue with a degenerate distribution for the interarrival times of customers, an exponential distribution for service times of customers, and *n* servers.
- E_k / E_l / 1 - This would describe a queue with an Erlang distribution for the interarrival times of customers (with a shape parameter of k), an exponential distribution for service times of customers (with a shape parameter of l), and a single server.
- M / M / *m* / K / N - This would describe a queueing system with an exponential distribution for the interarrival times of customers and the service times of customers, *m* servers, a maximum of K customers in the queueing system at once, and N potential customers in the calling population.

165. Kettenis, D. L., 1997, "An algorithm for parallel combined continuous and discrete-*event* simulation," *Simulation Practice and Theory*, Volume 5, Issue 2, 14 February 1997, Pages 167-184

Kettins (1997) presents the hybrid language COSMOS for PDES. Starting with a brief background for PDES, he then describes the structure of COSMOS. He provides the description of the algorithm for achieving PDES under COSMOS

166. Kewley, Jr, R. H., 2004, "Agent-Based Model Of Auftragstaktik," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Kewley (2004) recommends the use of clear mission objectives, and intent as related to agent based modeling. Compares modeling & simulation to a military mission.

167. Khan, A. and A. J. Day, 2002, “A Knowledge Based Design Methodology for manufacturing assembly lines,” *Computers & Industrial Engineering*, Volume 41, Issue 4, February 2002, Pages 441-467

Kahn and Day (2002) present the use of a knowledge base to schedule and optimize assembly for a manufacturing system, they consider alternative assembly lines (automated and manual). System is to reorganize batch and semi-batch assembly lines. Description seems similar to flexible manufacturing and the structure looks like PN, but is not called so.

168. Ki H. K., Y. R. Seong, T. G. Kim and K. H. Park, 1997, “Ordering of simultaneous events in distributed DEVS simulation,” *Simulation Practice and Theory*, Volume 5, Issue 3, 15 March 1997, Pages 253-268

Kim, et al. (1997) present an event ordering mechanism for handling simultaneous events of PDES models. The DEVS formalism provides framework for specifying discrete event models in a modular, hierarchical form. Discusses the problems in PDES and presents the theoretical structure for the formalism

169. Ki, M., E. Shayan and F. Ghot, 2002, “Investigation of port capacity under a new approach by computer simulation,” *Computers & Industrial Engineering*, Volume 42, Issues 2-4, 11 April 2002, Pages 533-540

Ki, Shavan, and Ghot (2002) present the development of a DES for modeling a container port operation.. Present the model and show typical results

170. Kim, B. and S. Kim, 2001, "Extended model for a hybrid production planning approach," *International Journal of Production Economics* Volume 73, Issue 2, 21 September 2001, Pages 165-173

Kim and Kim (2001) reprise the work of Byrne and Bakir (1999) using a different methodology which modifies both the left- and right-hand sides of the capacity constraints in the LP model. Their main goal is to look at:

(1) how much work each machine performs in each period for the the current production mix and volume, and

(2) how much of the full capacity is actually consumed by the current plan by each machine in each period.

They use a C++ derived simulation routine (type unstated).

171. Kim, K. J. and G. E. Gibson, Jr., 2003, “Interactive simulation modeling for heavy construction operations,” *Automation in Construction*, Volume 12, Issue 1, January 2003, Pages 97-109

Kim and Gibson (2003) propose a modular GUI system to allow faster building of simulations. Their system is based on a knowledge based interactive simulator built on CYCLONE. They present the use of interactive models and how they would work and describe the modules needed for such a system. They present the framework for their proposed system Knowledge-embedded, Modularized Simulation system (KMOS) and give an example of the system on an airport project

172. Klabbers, J. H. G. , 2003, “Gaming and simulation: Principles of a science of design,” *Simulation & Gaming*, Dec2003, Vol. 34 Issue 4, p569-591, 23p;

Klabbers (2003) presents an overview of CAS and how it developed. He describes three types of complexity:

- Algorithmic - mathematically reproducible systems, the information used to describe a system.
- Organizational - a system in transition, where no mathematical formula can adequately describe it.
- Organized - interaction of internal agents and actors

It is third type that covers CAS, and as such is important to consider when designing the simulation. He also deals with considering the design process and both the upper levels (design-in-the-large (DIL)) and the details (design-in-the-small (DIS)).

173. Klein, M., H. Sayama., P. Faratin, and Y. Bar-Yam, 2002, “A complex systems perspective on computer-supported collaborative design technology,” *Communications of the ACM* Volume 45, Issue 11 (November 2002) Pages: 27 - 31

Klein, Sayama, Faratin, and Bar-Yam (2002) describe the application of CAS theory to design review, in particular looking at symmetry and optimality.

174. Konyukh, V. and V, Davidenko, 1999, “Petri Nets as a Tool for Mine Simulation,” *Mineral Resources Engineering*; Dec99, Vol. 8 Issue 4, p361, 20p

Konvukh and Davidenko (1999) describe the use of Petri nets in underground mining (coal). Following a brief overview of Petri nets and their computer application they describe mining operations as PN's and review of conveyor simulation programs. Their article covers a lot of detail on constructing components, but not about the overall simulation

175. Kreutzer, W. and K. Østerbye, 1998, “BetaSIM: A framework for discrete event modelling and simulation,” *Simulation Practice and Theory*, Volume 6, Issue 6, 15 September 1998, Pages 573-599

Kreutzer and Østerbye (1998) describe the history, structure and use of BetaSim. The article is an introduction and overview of BetaSim (derived from SIMULA and DEMOS). They provide example of how BetaSim is used

176. Krishnamurthi, M. and S. Thallikar, 1998, “A Deadlock Detection Interface To A Commercial Simulation Language,” *Computers & Industrial Engineering* Volume. 34, No. 4, pp. 743-757, 1998

Krishnamurthi andThallikar (1998) pesent an algorithm that interfaces with SIMAN to identify potential deadlocks. They discuss the concept of deadlocks and consequences and presents how to find deadlocks using their algorithm.

177. Labadie, J. W., 2004, EG-610 Class Notes, EG 610 - Engineering Decision Support/Expert Systems, Colorado State University

Labadie (2004) presented the components that make up a decision support system as being a data base management system (DBMS), a user interface, and an analysis and modeling component. The DBMS is for:

- Coordination, integration, integrity, storage and extraction of information
- Separation of data and decision models

The user interface is for:

- user/model interaction; alerting
- Manipulate model--check logic
- Input data during model execution
- Define display preferences; colors, windowing

The analysis and modeling component is for:

- Statistical data analysis
- Forecasting algorithms
- Simulation, optimization and other OR methods
- Knowledge encoding

All DSS's must contain all 3 of these components to some extent. In general the requirements of DSS softeware are:

- End user friendly and interactive; self contained; on-line; End user designed
- Easy access to pertinent information
  - Data access and meaning
  - Variables; use of scripting languages (e.g., PERL)
  - Decision analysis techniques
  - Statistical, simulation and optimization tools
  - Syntax and semantics necessary for usage
  - Knowledge about rules
  - How information displayed
- High interaction between user and system
  - "...while quantitative methods and normative models are developing rapidly…nevertheless intuition, judgment and experience remain essential factors in the process of exploration of alternatives and the search for adequate tools" [Klein and Tixier (1971)]
- Ability to evolve to user needs
- Portability
- Reliability
- Acceptable performance

178. Lacksonen, T., 2001, "Empirical comparison of search algorithms for discrete event simulation," *Computers & Industrial Engineering*, Volume 40, Issues 1-2, June 2001, Pages 133-148

Lacksonen (2001) presents a method of using algorithms for optimization with a DES. He proposes that if a easy to use robust algorithm can be determined it will make the use of DES for system optimization easier. Four alternative algorithms are used with four simple simulation models and the results compared to determine which produced the most optimal solutions.

- Pattern search
- simplex

- simulated annealing
- genetic algorithm

Genetic algorithm performed best, followed by pattern search, simulated annealing, and simplex last. He discussed why each performed better or worse than others.

179. Law, A. M., 1975, "Efficient Estimators for Simulated Queueing Systems," *Management Science* 22, pp. 30-41.

Law (1975) presents a method to improve the efficiency of estimating the average number in the queue, mean waiting time, and other system performance measures. He calculates the values from the mean delay time instead of calculating the estimators directly. The method, while more intensive in the calculations, does require less informational storage, potentially reducing run time.

180. Law, A. M, 2004, "Statistical Analysis Of Simulation Output Data: The Practical State Of The Art," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Law (2004) presents a review of statistical analysis of simulations. Article is an overview of how to apply statistical analysis to simualtions and what some common errors are. He describes why spending more time on model development than analysis can be bad, and discusses how to appraoch the analysis using the ability of simulation runs to achieve some randomness. He gives examples of his take on a better appraoch.

181. Law, A. M. and J. S. Carson, 1979, "A Sequential Procedure For Determining The Length Of A Steady State Simulation", Operations Research, Vol. 27, Pp. 1011-1025, 4 citations

Law and Carson (1979) describe the problem faced in stochastic simulation in constructing a confidence interval (CI) that will adequately cover the true mean. They present a method using a sequential procedure and batch means for a CI with the desired level of coverage. They report that when using a batch size of 20 or more (examples use a batch size of 40) the distribution of the batch averages approaches a normal distribution. They present a procedure of dividing the results from a simulation into batches of equal size. They then take the average of each batch and show that if the results are split into enough batches and the individual batches are large enough, the individual batch averages will be normally distributed, and effectively be IID. A part of their work is based on selecting a covariance to achieve the desired batch size. The smaller the covariance the greater the batch size

182. Lawson, B. G., 2002, "Simulation techniques in an artificial society model," *Ph.D., dissertation The College of William and Mary*,

Lawson (2002) discusses agent based systems modeling and the application of asynchronous time advancement to improve model performance. He presents that most simulation systems use a synchronous method of time evolution and

this can have an impact on model results, especially when some components behave in an asynchronous manner. He proposes using asynchronous time and also allowing other than FCFS event scheduling (i.e. backfilling). Depending on the method of non-FCFS execution rate penalties can occur. In this work certain methods performed better.

183. L'Ecuyer, P., 1996, "Combined Multiple Recursive Random Number Generators", Operations Research, Vol. 44, No.5, pp. 816-822, 4 citations

L'Ecuyer (1996) presents a method for generating random numbers that can overcome an inherent problem with standard generators, the recycling of numbers. In most systems use linear congruent generators (LCG) which, if they are used long enough the sequences will repeat. With larger and faster computers running larger simulations standard random number generators can exhaust their period length in a short period of time (as quick as 30 minutes). This can cause statistical problems when striving for IID status. He proposes using combined multiple recursive generators (MRG), which are based on linear generators with high period lengths (2200+). L'Ecuyer proposes that MRG's of this length can overcome the problem with LCG's, but at a price. Combined MRG's can take twice as long as combined LCG's to generate the number

184. Lee, J.-H., 2005, "Basin-wide multi-reservoir operation using reinforcement learning," *Ph.D. dissertation Colorado State University*

Lee (2005) in his dissertation proposes a version of reinforcement learning called Q-learning with dynamic programming for a multi-criteria objective analysis methodology. This methodology is an AI type approach not requiring a priori knowledge of anticipated results. Q-learning works by learning an action-value function that gives the expected utility of taking a given action in a given state. Q-learning does not require a model of the environment (or a priori) bur can be used with varying and changing conditions. Lee presents the use of Q-learning to manage a multi-basin reservoir system in Korea (Keum river basin). His approach (being model free) is based on historical data, and not expected conditions. Results were as good as more traditional methods requiring a model of the system.

185. Lee, L., E. Chew, S. Teng, and Y. Chen, 2007, "Multi-objective simulation-based evolutionary algorithm for an aircraft spare parts allocation problem," European Journal of Operational Research, Volume 189, Issue 2, 1 September 2008, Pages 476-491

Lee, et Al. (2007) present a simulation optimization system that uses an evolutionary algorithm with simulation. Their method was selected due to the large search space involves, multiply objectives, and high variability. The system has three components, simulation to estimate the performance, the evolutionary algorithm to search for the more promising designs, and a second algorithm to identify the non-dominated designs by allocating simulation replications. Their system is used to size an inventory level for a aircraft spare parts system.

186. Lee, Y. H., M. K. Choa, S. J. Kimb and Y. B. Kimc, 2002, “Supply chain simulation with discrete–continuous combined modeling,” *Computers & Industrial Engineering* Volume 43, Issues 1-2, 1 July 2002, Pages 375-392

Lee et al. (2002) describe the use of stochastic analysis in a discrete/continuous simulation for supply chain scheduling and planning.

187. Leu, S.-S. and S.-T. Hwang, 2002, “GA-based resource-constrained flow-shop scheduling model for mixed precast production,” *Automation in Construction* Volume 11, Issue 4, June 2002, Pages 439-452

Leu and Hwang (2002) describe the use of genetic algorithm for optimization.

188. Levasseur, G. A. and R. L. Storch, 1996, “A Non-Sequential Just-In-Time Simulation Model,” *Computers & Industrial Engineering* Volume 30, No. 4, pp. 741-752, 1996

Levasseur and Storch (1996) describes the logic for a non-sequential manufacturing system with minimal queues lengths. Their model uses SLAM and Fortran

189. Li, H., 1998, “Petri net as a formalism to assist process improvement in the construction industry,” *Automation in Construction*, Volume 7, Issue 4, May 1998, Pages 349-356

Li (1998) proposes the use of Petri nets for system improvement. He provides a review of Petri nets and how they are used and includes adding colors, times and hierarchies to base Petri nets. He argues that using the Petri net concept as a formal procedure for system optimization

190. Lin, J. T., K.-C. Yeh and L.-C. Sheu, 1996, “A Context-Based Object-Oriented Application Framework For Discrete Event Simulation,” *Computers & Industrial Engineering* Volume. 30, No. 4, pp. 579-597, 1996

Lin, Yeh and Sheu (1996) present using objected oriented programming to develop a simulation language from a general programming language. They compares some SPL's (SIMULA, SIMAN, & MODSIM) and how they are structured. They then explains a method of using OOP to develop a SPL from a GPL based on three modules, Services, Model, Scheduler. They provides a implementation CSMIT++ (C++ simulation Toolkit) developed from PASIMT.

191. López-Mellado, E., 2002, “Analysis of discrete event systems by simulation of timed Petri net models,” *Mathematics and Computers in Simulation* Volume 61, Issue 1, 1 November 2002, Pages 53-59

López-Mellado (2002) describes the use of timed Petri nets for simulation. In addition to presenting brief overview of TPN's he describes the algorithm used and presents a simple example.

192. López-Mellado, E., N. Villanueva-Paredes and H. Almeyda-Canepa , 2005, “Modelling of batch production systems using Petri nets with dynamic tokens,”

Mathematics and Computers in Simulation, Volume 67, Issue 6, 3 January 2005, Pages 541-558

López-Mellado, Villanueva-Paredes and Almeyda-Canepa (2005) describes the use of PN for modelling a batch system. They describes what a batch system is and why augmented PN's are suited. They provides a case study showing using PN's in a chemical batch process plant and claims that augmented PN's are well suited for this use.

193. Ma, H. H., 2004, "Simulation ranking and selection using transient and artificial data," *Ph.D. dissertation Rensselaer Polytechnic Institute*,

(Ma's (2004) dissertation is the basis for the paper with Willemain.) Ma (2004) describe a new approach that uses a few short simulation runs that begin with the alternative systems empty and idle and does not delete the transient data. The method then augments these data with artificial data created by a new variant of time series bootstrapping, bootstrapping with mirroring (BWM). The results are then compared to the KN++ method results by duplicating the experiments in GKMN. The new method achieved an equal or better probability of correct selection with substantially fewer simulation observations (shorter runs).

194. Ma, H.H., and T. R. Willemain, 2004, "Better selection of the best," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds. Volume: 1, On page(s): - 644

Paper based on Ma dissertation. Ma and Willemain (2004) describe a new approach that uses a few short simulation runs that begin with the alternative systems empty and idle and does not delete the transient data. The method then augments these data with artificial data created by a new variant of time series bootstrapping, bootstrapping with mirroring (BWM). The results are then compared to the KN++ method results by duplicating the experiments in GKMN. The new method achieved an equal or better probability of correct selection with substantially fewer simulation observations (shorter runs).

195. Mains, S., 2004, "Optimizing combat capabilities by modeling combat as a complex adaptive system," *Ph.D. dissertation The College of William and Mary*

Mains (2004) dissertation presents a theoretical basis for using agent-based simulations to model combat systems procurement. As there are multiple and changing criteria he describes the problem as "a stochastic, mixed-integer, non-linear optimization problem." To solve these Mains proposes using a combination of agent-based models with a co-evolutionary genetic algorithm to search a hyper-dimensional solution space. Mains also examined increasing the amount of information in the system. Using this approach the result was more solutions that were workable, rather than improving the fit of the best solutions. Increased information flow improved previously poor solutions, but did not improve already fit solutions.

196. Martinez, C. and P. Castagna, 2003, "Sizing of an industrial plant under tight time constraints using two complementary approaches: (max,+) algebra and computer simulation," *Simulation Modelling Practice and Theory* Volume 11, Issue 1, 15 March 2003, Pages 75-88

Martinez and Castagna (2003) compare two alternative ways to size a time constrained plant

- spectral algebraic approach
- DES using Arena

Results are complementary, with the DES being simpler to apply and understand

197. Martinez, J. C., 1998, "Earthmover simulation tool for earthwork planning," *Proceedings of the 1998 Winter Simulation Conference*, 1263-1271.

Martinez (1998) presents a special purpose simulation built on Stroboscopic. The s System uses other software and integrates it into one system. He describes the development and purpose of Earthmover and provides an example of use.

198. Mayer, E. and J. Raisch, 2004, "Time-optimal scheduling for high throughput screening processes using cyclic discrete event models," *Mathematics and Computers in Simulation* Volume 66, Issues 2-3, 29 June 2004, Pages 181-191

Mayer and Raisch (2004) present the use of mixed integer programming for optimization of a DES simulation. Using a DES of a chemical screening system a set of cyclical runs are optimized using mixed integer programming.

199. Mazziotti, B. W. and R. E. Horne, Jr., 1997, "Creating A Flexible, Simulation-Based Finite Scheduling Tool," *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Mazziotti and Horne (1997) present an examination of a DES (ARENA) used for scheduling in the clothing industry. They describe the organization of files and model for a clothing mfg.

200. McCabe, B., 1998, "Belief networks in construction simulation," *Proceedings of the 30th conference on Winter simulation*, Dec-98

McCabe (1998) presents a method for automatically improving the performance of a simulated operation through the integration of computer simulation and artificial intelligence, specifically belief networks.

201. McGrath, D., M. Ryan and D. Hill, 2005, "Simulation Interoperability with a Commercial Game Engine," *European Simulation Interoperability Workshop 2005*, 27-30 June 2005.

McGrath, Ryan, and Hill (2005) present that game engines can be used as platforms for serious simulation. Game engines have made great advances in user interaction and visualization at low cost that have exceeded advances within the simulation community. The advances in game engines unfortunately has occurred without interoperability standards similar to HLA. If games engines are to be genuinely useful to the simulation community, they must be interoperable

with existing simulations and simulation software. They propose to do this by modification of Gamebots interface to allow external simulations to control the state of internal game objects.

202. Mckay, M. D., J. D. Morrison, and S. C. Upton,, 1999, “Evaluating Prediction Uncertainty In Simulation Models,” *Computer Physics Communications*, Volume: 117, Issue: 1-2, March 1, 1999

McKay, Morrison and Upton (1999) describe the types of uncertainty found in simulation models and their impact on the simulation results. Types of uncertainty, include simulation variability (desired variability (stochastic) as part of modeling real world), input uncertainty (caused by variability in input values, due to incomplete or incorrect knowledge of values), and structural uncertainty (caused by model design and structure and related to mathematical assumptions used). They describes how the input and structural uncertainty are caused and strategies for evaluating their impact on validation. They present an example on airplane capacity and fuel consumption

203. McKenny, J. L., 1967, "Critique of: Verification of Computer Simulation Models", Management Science Vol 14, No. 3

McKenney (1967) in his critique of Naylor and Fingers paper infers that computer simulation is done only when numerical modeling is too complex. Computers and computer simulations were new tools, and how to evaluate them was just becoming important to regular users.

204. McMullin, B., 2004, “Thirty years of computational autopoiesis: a review,” *Artificial Life*, Volume 10 Issue 3, Jun-04

McMullin (2004) is an overview of computational autopiesis, the mathematical modeling of artifical life.

205. McNearny, R. L. and Z. Nie, 2000, “Simulation of a Conveyor Belt Network at an Underground Coal Mine,” *Mineral Resources Engineering* 9, no. 3 (2000): 343-355

McNearny and Nie (2000) present the development and validation of a underground coal mine conveyor system model using GPSS/H. Include a description of the conveyor system, how the model was created and data gathered, the method of validation of the model, and the experiments performed to optimize the conveyor system

206. Mellor, W., E. Wright, R. Clift, A. Azapagic, and G. Stevens., 2002, “A mathematical model and decision-support framework for material recovery, recycling and cascaded use*,” Chemical Engineering Science*, Vol.57 no.22-23, 2002

Mellor, et al. (2002) present the use of simulation in the recycling industry

207. Miller, J.A., G.T. Baramidze, A.P. Sheth, and P.A. Fishwick, 2004, "Investigating Ontologies for Simulation Modeling," Simulation Symposium, 2004. Proceedings. 37th Annual, 18-22 April 2004 Page(s):55 - 63

Miller, et al. (2004) review the use of taxonomies and ontologies for simulation, especially involving internet based systems. They describe in more detail RUBE, OWL, SWRL and DeMO. Present diagramatically their take on how DES relates to DeMO (Discrete Event Modeling Ontology). Through this they relate the major worldviews and SPL's. they build their case for DeMO and how it can help relate divergent work.

208. Mireles, Jr. J., and F. L. Lewis, 2001a, "On the development and implementation of a Matrix-Based Discrete Event Controller," *Mediterranean Conference on Control MED01*, Zagreb June 2001

Mireles and Lewis (2001a) present using a DES for actual control. A form of DES is used to perform actual operational control of a robotic manufacturing system. They uses Labview and Matlab.

209. Mireles, Jr. J., and F. L. Lewis, 2001b, "Intelligent Material Handling: Development And Implementation Of A Matrix-Based Discrete-Event Controller," *IEEE Transactions On Industrial Electronics*, VOL. 48, NO. 6, DECEMBER 2001 1087

Mireles and Lewis (2001b) presents a supervisory control method for discrete event systems using a matrix formulation and Petri-nets. They develop the mathematical model and compare the simulation with actual results taken from a test rig. They use Labview and Matlab for development of model

210. Molina, M., 2005, "Building a Decision Support System with a Knowledge Modeling Tool," *Journal of Decision Systems. Special issue "Design, Building and Evaluation of Intelligent Decision-making Support Systems*". VOL 14/3 - 2005 - pp.303-320,

Molina (2005) describe the use of a knowledge management system (KSM) with a system (CONCEL) to create a ontological level description of a model. And then using a conversion system (LINK) to creat the actual model. He presents an integrated DSS using real world data connected to a knowledge base, they verify results using a simulation feature to predict future results. The system starts at high levels and by the use of reconstructed subtasks works down through the knowledge levels to create an operational system.

211. Molina, M., J. Hernandez, and J. Cuena, , 1998, "A structure of problem-solving methods for real-time decision support in traffic control," *International Journal of Human-Computer Studies*, vol. 49, no. 4, October 1998.

Molina, Hernandez, and Cuena (1998) present an application of a knowledge management system (KSM) for traffic management.

212. Molina, M., J. L. Sierra, and J. Cuena, 1999, "Reusable Knowledge-based Components for Building Software Applications: A Knowledge Modelling Approach," *International Journal of Software Engineering and Knowledge Engineering*. Vol 9. No. 3 (1999) 297-317.,

Molina, Sierra, and Cuena (1999) presents an integrated DSS using real world data connected to a knoweldge base (KMS) with a simulation feature to predict future results.

213. Moreno-Lizaranzu, M. J., R. A. Wysk, J. Hong, and V. V. Prabhu, 2001, "A hybrid shop-floor control system for food manufacturing," *IIE Transactions*, volume 33 issue 3: pp193-202, March 2001

Moreno-Lizaranzu , et al. (2001) present the use of a DES in a control function

214. Myers, D., 2005, "What's good about bad play?", *Proceedings of the second Australasian conference on Interactive entertainment IE2005*, Nov-05

Myers (2005) proposes that bad play in digital games – prominently including cheats, griefs, and exploits – is formally similar to and, in fact, a logical extension of good, proper,

215. Nance, R. E., 1993, "History of Discrete Event Simulation Programming Languages," *Proceedings of the Second ACM SIGPLAN History of Programming Languages Conference*, Cambridge, MA, April 20-23, Reprinted in ACM SIGPLAN Notices, 28(3), pp.149 175.

Nance (1993) describes what discrete event simulation is and how it differs from continuous simulation and Monte Carlo simulation, following Overstreet (1982) and Lackner he establishes a conceptual frameworks for discrete event simulation by its "Worldview".

- event scheduling
- activity scanning
- process interaction

He traces the development of the major types of discrete event simulation software by their world view, and identifies the following six characteristics of a discrete event simulation language. In his view discrete event simulation programming languages (SPLS) must meet a minimum of six requirements:

- generation of random numbers to represent uncertainty,
- process transformers, to permit other than uniform random varieties to be used,
- list processing capability, so that objects can be created, manipulated, and deleted,
- statistical analysis routines, to provide the descriptive summary of model behavior,
- report generation, to provide the presentation of potentially large reams of data in an effective way for decision making, and
- a timing executive or time flow mechanism.

He then contrasts the development of DES from 1955 through 1986 by historical period and describes the software developed during each period.

- search 1955-1960
- advent 1960-1965
- formative period 1965-1970
- expansion period 1970-1980

- consolidation and regeneration 1980-1986(+)

216. Nance, R. E.., 1995, “Simulation Programming Languages: An Abridged History,” *Proceedings of the 1995 Winter Simulation Conference* ed. C. Alexopoulos, K. Kang, W. R. Lilegdon, and D. Goldsman

Nance (1995) is an often cited, abridged version of the 1993 work. He reiterates most of the same items as before.

217. Nance, R. E., C. M. Overstreet, and E. H. Page, 1999, “Redundancy in model specifications for discrete event simulation,” *ACM Transactions on Modeling and Computer Simulation (TOMACS*), Volume 9 Issue 3, Jul-99,

Nance, Overstreet, and Page (1999) recommend including redundancy in a model during the design phase and then using an automated method of educing the redundancy prior to running. Execution efficiency and model development often have different requirements. The describe types of redundancy that can exist, how these redundancies can improve model development, how they can effect execution, and methods to reduce them prior to execution.

218. Nance, R. E. and R. G. Sargent, 2002, “Perspectives On The Evolution Of Simulation,” *Operations Research*, Jan/Feb2002, Vol. 50 Issue 1, p161, 12p;

Nance and Sargent (2002) provide an overview on the history and development of simulation, particularly DES. They describe the different types of simulation and its uses

- System analysis
- education and training
- system acceptance
- research
- entertainment

They also describe different types of simulation by its time state

- discrete
- continuous
- hybrid

They provides a brief history of simulation and its development along with computers and computer software to include a review technical factors in the development of simulation

- hardware
- software
- other technologies (computer graphics, human interface, networks, internet)

They then describe the development of what is include in simulation to include V & V, and the growth in theory and analysis. From there they describe the impact of being a profession, and conferences and a community and what they believe what the future of simulation will be like.

219. Narayan, V. C., 2004, “Object-oriented discrete event simulation profiler,” *Masters thesis The University of Alabama in Huntsville*,,

Narayan (2004) thesis presents the use of a software profiler (Glowcode) in conjunctionwith an expert system (CLIPS). The profiler creates a listing of the classes used in a C++ program and their inheratence. Narayan proposes using this system to examine DES project to evaluate the execution performance of DES models.

220. Nassara, K., W. Thabetb and Y. Beliveauc, 2003, "Simulation of asphalt paving operations under lane closure conditions," *Automation in Construction* Volume 12, Issue 5, September 2003, Pages 527-541

Nassara, Thabetb And Beliveauc (2003) presents a DES developed in Stroboscope used to schedule lane closure in a paving operation. They describe the model and present a case study

221. Naylor, T.H. and J. M. Finger, 1967, "Verification of Computer Simulation Models", Management Science, Vol. 14, No.2, pp: 92-101, 4 citations

Naylor and Finger's (1967) work is one of the earliest discussions on formal computer simulation verification and validation. While they consistently refer only to verification, what they describe is now generally referred to as verification and validation. The work has two major components, the first being defining the "why" of verification and contrasting alternative philosophies. The time that this was written (1966) and published (1967) was in the early formative stages of discrete event simulation (Nance (1995)). Simulation programming languages were just being developed, and computer usage was gaining ground. The need for formalized verification and validation was just being recognized.

222. Nicol, D. M., J. Liu, M. Liljenstam, and G. Yan, 2003, "Simulation Of Large-Scale Networks Using SSF," *Proceedings of the 2003 Winter Simulation Conference* S. Chick, P. J. Sá nchez, D. Ferrin, and D. J. Morrice, eds., New Orleans, LA Dec 7-10,

Nicol , et al. (2003) describe Scalable Simulation Framework (SSF), a method to achieve very high simulation speeds by using uses hierarchical levels of abstraction, and parallelism. Using a communication network example they show how SSF achieves high speed.

223. Nidumolu, S. R., N. M. Menon and B. P. Zeigler, 1998, "Object-oriented business process modeling and simulation:: A discrete event system specification framework," *Simulation Practice and Theory*, Volume 6, Issue 6, 15 September 1998, Pages 533-571

Nidumolu, et al. (1998) describe the use of DES in business process re-engineering.

224. Odhabi, H. I., R. J. Paul and R. Macredie, 1999, "Java Iconic Visual Environment for Simulation (JIVESim)," *Computers & Industrial Engineering*, Volume 37, Issues 1-2, October 1999, Pages 243-246

Odhabi, Paul and Macredie,(1999) describe the use of a JAVA based GUI simulation system using inherent features of JAVA coupled with s simulation engine. The simulation engine appears to be Micro-SANT

225. O'Keefe, R. M. and J. W. Roach, 1987, “Artificial Intelligence Approaches to Simulation,” *The Journal of the Operational Research Society* > Vol. 38, No. 8, Current Simulation Research (Aug., 1987), pp. 713-722

O’Keefe and Roach (1987) describe how AI often requires a simulation component to analyze the results from choices. The corollary is also true, that using an AI component in a DES model can improve the usability of the package. They present PROSS (PROlog simulation system) to allow integration of AI and DES.

226. Oloufa A.A., M. Ikeda; and T.-H.Nguyen, 1998, “Resource-based simulation libraries for construction,” *Automation in Construction*, May 1998, vol. 7, iss. 4, pp. 315-326

Oloufa, Ikeda and Nguyen (1998) present the use of library modules to expedite simulation development. Beginning with an overview of DES in construction applications, and the use of GUI for ease of model development, they describe some library modules used for a tunnel application. They show the development of alternative models using the library components. The models are developed in MODSIM

227. Orady, E. A. and T. A. Osman, 1997, “Virtual reality software for robotics and manufacturing cell simulation,” *Computers & Industrial Engineering* Volume 33, Issues 1-2, October 1997, Pages 87-90

Orady and Osman (1997) present the integration of virtual reality with a DES to model an automotive assembly system. Describe how DES, robotics, and their simulation can be integrated (overview)

228. Overstreet, C. M., 1982, "Model specification and analysis for discrete event simulation", *PhD Disertation Virginia Polytechnic Institute and State University*

Overstreet (1982) presents the first articulation of world view as a means to identify by locality. Defines DES world views (following Lackner/Kiviat) as:

- Event Scheduling – when actions are to occur, emphasizes schedualing of actions at particular points in time.
- Activity scanning – why actions are to occur, emphasizes the reasons that model actions occur.
- Process interaction – describes the components or subsystems and the sequence of actions of each individually, empahsises system behavior by defining the action sequences of each component.

He also defines:

- Model specification – what a model is to do (behavior)
- Model implementation – how that behavior is to be achieved

He presents a condition specification language as a first step to translating a model specification into a simulation programming language.

- The condition specification is independent of the world views.
- The CS can also be used to define complexity.
- Also supports error detection.

- The CS can help in choosing the appropriate SPL.
- Can describe most DES problems
- Can define an algortitm of the problem

229. Overstreet, C. M. and R. E. Nance, 2004, "Characterizations And Relationships Of World Views," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Overstreet and Nance (2004) present how automatic translation is impacted by worldview. They use the concept of Action Cluster Interaction Graphs (ACIG) to show what is involved in transforming from one worldview to another. Using the repairman typical example shows how event scheduling, activity scanning, and process interaction would be structured. Also discuss how the worldview simplifications effect converting from one to the other.

230. Padmanaban, N., 1997, "A knowledge-based approach to build simulation models of complex manufacturing systems," *Ph.D. dissertation Texas A&M University*

Padmanaban (1997) dissertation is on the use of IDEF3, and how it can be seen as an ontological basis for developing a description of the model. From the description development a knowledge base can be used to automate model creation. It is part of the US Air force work on Integrated Definition methods (IDEF); this work is on IDEF3 Process Description Capture Method. IDEF3 is about going from process descriptions to a simulation model. This starts with a description of how the system should function. It is based on an empirical approach instead of a theoretical approach. IDEF3 uses either process flow (process interaction) or object state transactions (event scheduling/activity scanning). Makes the ascertain that different participants can see a system differently, and thus any system could be described using different descriptions. These can generally be combined to give a better model.

231. Page, E. H., 1994, "Simulation Modeling Methodolgy Principles and Etiology of Decision Support," *PhD Dissertation Virginia Polytechnic Institute and State University*

Page (1994) in his dissertation stated that discrete event simulation at its most fundamental level as a tool for decision support. He also stated that discrete event simulation models may adopt myriad forms:

- A single, large, relatively static model that serves over a protracted period of use, e.g. a weather simulation.
- A single model which evolves rapidly during experimentation for system design or optimization, e.g. a cache model.
- A model which consists of a synthesis of results from several existing models in an effort to answer questions on a metasystem level.
- Models used for analysis.
- Models used to animate and visualize systems.
- Models used to provide an interactive training environment.
- Models used to stimulate hardware prior to operational deployment.
- Models used for real-time decision support.

- Models which provide various combinations of the above.

232. Page, E. H., P., Canova, B.S., Tufarolo, J.A., 1997, “A Case Study of Verification, Validation and Accreditation for Advanced Distributed Simulation.,” *ACM Transactions on Modeling and Computer Simulation*, 1997. 7(7),, p. 393-424, 1997
Page, Canova, and Tufarolo (1997) present a case study of V&V in a distributed DES system military application

233. Park, J., R. Moraga, L. Rabelo, J. Dawson, M. Marin, and J Sepulveda, 2005, "Addressing complexity using distributed simulation: a case study in Spaceport modeling," Proceedings of the 37th conference on Winter simulation, Pp: 1804 - 1812
Park, et al. (2005) describe the use of the Virtual Test Bed (VTB) integrating commerical simulation packages using the DMSO Higher Level Architecture (HLA) framework. They base their work on the need to simulate complex systems (a spaceport) using off the shelf models from different vendors.

234. Pathak, S. D., 2005, “An investigative framework for studying the growth and evolution of complex supply networks,” *PhD. Dissertation Vanderbilt University*
Pathak's (2005) dissertation looks at how supply chains (he uses Supply Networks (network of firms transforming raw material into finished products)) grow and emerge, and if there are there simple rules and conditions that control the growth and emergence process. His work is based on modeling a supply chain base as a CAS. He proposes a Unified Model of Supply Network (UMSN) based on Industrial growth theory (Utterback 1994), Network growth theory (Newman 2003), market structure theory (Shy 1995), (Tirole 1989), game theory (Osborne and Rubinstein 1994) and complex adaptive systems theory (Schuster 2001), (Kauffman 1995), (Holland 1995). To this theoretical base he then adds a simulation based computational framework that can provide a “what if” analysis platform for performing scenario analysis (CAS-SIM (Complex Adaptive Supply Networks Simulator)). CAS-SIM uses a multi-agent-based technique to model the CAS aspects of the supply chain. CAS-SIM uses MadKit (Multi agent development kit) (a Java based agent package) (Ferber 2004) as the agent platform. MadKit provides a bare bone agent infrastructure where the modeler has to write the behavioral description of the agents in Java. MadKit uses a CORBA (Common Object Request Broker Architecture) based platform for implementing a message based communication infrastructure.

235. Paul, R. J., 1991, “Recent Developments in Simulation Modelling,” *The Journal of the Operational Research Society* > Vol. 42, No. 3 (Mar., 1991), pp. 217-226
Paul (1991) describes his view of the future of simulation as of 1991, much has transpired since then.

236. Paulo, E. P. and L. C. Malone, 2001, “Increasing efficiency in the simulation of a dynamic system of objects in 3-D space,” *Simulation Practice and Theory*, Volume 8, Issues 6-7, 15 March 2001, Pages 473-490
Paulo and Malone (2001) compare two alternative methods for locating objects

- sectoring
- non-sectoring

They present that to improve efficiency (speed) in 3-D DES need to improve speed of algorithm to identify locations and compare the two and shows sectoring is better

237. Pawlikowski, K., D. C. Mcnickle and G. Ewing, 1998, "Coverage of confidence intervals in sequential steady-state simulation," *Simulation Practice and Theory*, Volume 6, Issue 3, 15 March 1998, Pages 255-267

Pawlikowski, Mcnickle and Ewing (1998) present guidelines for determining stopping point based on CI for DES. They review the background of determining that a simulation has reached the proper CI stopping point and methods used. They review two methods for steady-state analysis

- non-overlapping batch means
- spectral analysis

238. Pederson, D. E. and C. E. Trout, 2002, "Demonstrated Benefits Of Cluster Tool Simulation," *Proceedings of the 2002 International Conference on Modeling and Analysis of Semiconductor Manufacturing*

Pederson and Trout (2002) discuss the uses of a DES to determine the bottlenecks and capacity constraints of a manufacturing process. They compares a DES (in SIGMA) to a spreadsheet for determining the capacity and constraints of a manufacturing system. They use a semi-conductor wafer fab machine to compare the alternative methods for capacity determination. The spreadsheet needed some a priori information on what the bottlenecks where, while the simulation determined them a postoria.

239. Peng, C. and F. F. Chen, 1996, "Parallel discrete event simulation of manufacturing systems: A technology survey," *Computers & Industrial Engineering*, Volume 31, Issues 1-2, October 1996, Pages 327-330

Peng and Chen (1996) describe what Parallel Discrete Event Simulation is and how it works. They discuss the literature that describes use of PDES and some of the problems encountered in using PDES.

240. Perrone, G., A. Zinno and N. La Diega, 2001, "Fuzzy discrete event simulation: A new tool for rapid analysis of production systems under vague information," *Journal of Intelligent Manufacturing*. volume 12 issue 3: pp 309-326, June 2001

Perrone, Zinno, and La Diega (2001) present an application of fuzzy concepts to DES. In agile manufacturing, there may not be enough lead time to collect adequate data for standard modeling proceedures, this leads to the use of fuzzy logic whihc can cause problems in DES. They describe three areas where fuzzy logic impacts upon DES; event selection, simulation clock updating, and activity selection. Of these, the second (clock time) is relatively straight forward, and can be considered as part of the normal delay time activity of clock updating. The other two are more problematic, and can lead to a time paradox where the clock

actually needs to back up to cover the actual events in proper sequence. Their solution is to iterate through to achieve a minimal time paradox.

241. Persson, A., H. Grimm, A. Ng, T. Lezama, J. Ekberg, S. Falk, And P. Stablum, 2006, "Simulation-Based Multi-Objective Optimization of a Real-World Scheduling Problem," *Proceedings of the 2006 Winter Simulation Conference*, L. F. Perrone, F. P. Wieland, J. Liu, B. G. Lawson, D. M. Nicol, and R. M. Fujimoto, eds. 3-6 Dec. 2006 Page(s):1757 - 1764

Perssone, et al. (2006) present an approach similar to Byrne and Bakir (1999), Kim and Kim (2001), and Byrne and Hossain (2005) using an iterative approach with a analytical and simulation component of the Swedish postal systems sorting stage. They state that while multi-objective optimization is an active research area in their literature review they found "few attempts in the area of simulation-based multi-objective optimization." And that of this even less information was found on operation scheduling problems. They propose that future work should include incorporating the system into a DSS.

242. Petropoulakis L. and L. Giacomini, 1998, "Development of a hybrid simulator for manufacturing processes," *Computers in Industry*, Volume 36, Number 1, 30 April 1998 , pp. 117-124(8)

Petropoulakis and Giacomini (1998) present a system for modeling a manufacturing process using both continuous and discrete model components. They present that few manufacturing systems are purely discrete or continuous, but rather a combination of both. They propose a combined discrete and continuous system. Their system uses Simple++ as the DES component and SAM for the continuous portion. The DES is top level system which call the continuous portion as needed. This would compare to a type IV system as described by Shanthikumar and Sargent (1983).

243. Pidd, M., 2004, "Simulation Worldviews So What?," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Pidd (2004) describes the place of worldviews in current simulation environment. He presents that most users do not need to understand the worldview and what it means, but for academia, and some large scale users it is still important.

244. Pidd, M. and R. B. Castro, 1998, "Hierarchical Modular Modelling In Discrete Simulation," *Proceedings of the 1998 Winter Simulation Conference* D.J. Medeiros, E.F. Watson, J.S. Carson and M.S. Manivannan, eds.

Pidd and Castro (1998) describe a method of developing a large system model with lower internal complexity. They reviews the concept of module simulation through coupling as defined by others. And then they discuss modular concepts in light of hierarchies and object oriented programming. They presents the concept that each system, while it may be constructed of standard components, has its own logical and unique structure. The conclude that some relaxation of the pure modularity of DES can improve performance and the results gained.

245. Porr, B. and F. Wörgötter, 2003, “Isotropic sequence order learning,” *Neural Computation*, Volume 15 Issue 4, Apr-03

Porr and Wörgötter (2003) describe an algorithmic approach for knowledge based learning. They present a feed back loop procedure for training agents in an AI environment. Their presented example is an application for robotic training.

246. Pugh, G. A., 1997, “Fuzzy allocation of manufacturing resources,” *Computers & Industrial Engineering*, Volume 33, Issues 1-2, October 1997, Pages 101-104

Pugh (1997) uses a DES evaluate alternative allocation techniques. He compares random, largest queue, and fuzzy allocation techniques using a DES model as a test platform (Extend). His results showed a fuzzy controller to be a feasible alternative.

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247. Radiya, A. and R. G. Sargent, 1987, “A New Formalism for Discrete Event Simulation,” *Proceedings of the 1987 Winter Simulation Conference* A. Thesen, H. Granit, W. David Kelton (eds.)

Radiva and Sargent (1987) present the generally accepted requirements for a DES. As part they describe the elements of a modelling formalism

- Model Specification Language
- Semantics
- Model its Structure and Behavior
- Specification of Model Validity
- Proof System
- Modeling Methodology

248. Raffo, D., G. Spehar and U. Nayak, 2003, “Generalized Simulation Models: What, Why and How?,” *Prosim'03* Portland State univeristy May 3-4, 2003

Raffo, Spehar and Navak (2003) present using a generalized model for developing simulations faster. They describe an approach using modular pieces to quickly develop a process simulation. Their goal is to improve usability and make the results easier to come by, and to allow use in areas or fields not previously used. They define the project by components and results not by pieces.

249. Rasmussen, S., N. A. Baas, B. Mayer, M. Nilsson, and M. W. Olesen, 2002, “Ansatz for dynamical hierarchies,” *Artificial Life*, Volume 7 Issue 4, Mar-02

Rasmussen, et al. (2002) describes a system for modeling dynamic structure evolution. They present this as a framework for developing an ansatz for autopetic systems. NB,. Ansatz is an assumed form for a mathematical function that is not based on any underlying theory or principle."

250. Reyes, A., H. Yu, G. Kelleher and S. Lloyd, 2002, "Integrating Petri Nets and hybrid heuristic search for the scheduling of FMS," Computers in Industry, Volume 47, Issue 1, January 2002, Pages 123-138

Reyes, Yu, Kelleher and Lloyd (2002) present the use of Petri Nets (PN's) combined with a heuristic seach algorithm for an AI mehtod of schedualing flexible manufacturing systems (FMS). They describe a system of buffered PN's (called B nets) to model a FMS. Following a description of PN's and how they work the FMS model is developed. Then they use a heuristic search to work through alternative scheduals. (see Yu, Reyesb, Cangc, and Lloydd (2003) for further work.)

251. Riedl, M., 2005, "Towards Integrating AI Story Controllers and Game Engines: Reconciling World State Representations," *IJCAI Workshop* 2005

Riedl (2005) describes the application of game engines to interactive (AI based) story telling. He presents that game engines are generally not deigned to interface with an AI engine, and then shows a method to do so.

252. Ritter, F., 1998, "Mining Simulation: Multipurpose Models For Large Scale Ssyems," Internship *report, "Otto von Guericke" University Magdeburg*, June 9, 1998

Ritter (1998) in his internship report describes the approaches to developing multipurpose models for complex systems. He describes the DOD HLA approach to developing multipurpose models, and presents the advantages of using animation for enhanced visualization. He also presents the deployment of a model system for Kennecott's Greens Creek mine, using GPSS/H and Proof

253. Rizzoli, A. E., N. Fornara and L. M. Gambardella, 2002, "A simulation tool for combined rail/road transport in intermodal terminals," *Mathematics and Computers in Simulation* Volume 59, Issues 1-3, 10 May 2002, Pages 57-71

Rizzoli, Fornara and Gambardella (2002) present the use of DES to simulate a series of intermodal terminals. Following an overview of what intermodal terminals are they describe issues in their simulation. Their model was prepared using MODSIM III. They give a brief description of the experiments conducted

254. Roberts, C., M. M. Dessouky, and Y. M. Dessouky, 1999, "A Virtual Plant Modeler for Batch Chemical Processes," *Journal of Intelligent Manufacturing*, Volume 10, Number 2, April, 1999, pp. 211-223

Roberts, Dessouky, and Dessouky (1999) describe the development and use of "A Virtual Plant Modeler (VPMOD)" for multipurpose chemical batch plants. They differentiate multiproduct (same path different product) from multipurpose (different path different product) processes. After reviewing other approaches they describe VPMOD as an early integrated DSS approach. VPMOD can accept alternative orders and flow paths, but the ability to perform alternative results analysis is limited.

255. Robinson, S., 1997, "Simulation Model Verification And Validation: Increasing The Users' Confidence," *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Robinson (1997) reviews what V&V is and how it relates to simulation development. He describes four stages of V&V

- Conceptual Model Validation:
- Data Validation:
- White-box Validation:
- Black-box Validation:

He proposes that each stage is to increase overall confidence with the end results.. He describes how to achieve V&V and the methods to do them and discuses some of the problems inherent in V&V

256. Robinson, S., R. E. Nance, R. J. Paul, M, Pidd and S. J.E. Taylor, 2004, "Simulation model reuse: definitions, benefits and obstacles," *Simulation Modelling Practice and Theory* Volume 12, Issues 7-8, November 2004, Pages 479-494

Robinson et al. (2004) provide a review of issues related to reusing parts of one model for another. It inherently sounds good and easy, but the reality maybe quite different. Reuse depends heavily on the two applications AND who is doing the models

257. Roeder, T., S. Fischbein, M. Janakiram, and L. Schruben., 2002, "Resource-Driven and Job-Driven Simulations*," Proceedings of the 2002 International Conference on Modeling and Analysis of Semiconductor Manufacturing*: 78-83.

Roeder, et al. (2002) contrast a resource driven model with a job driven model. They compare a resource driven model (SIGMA) to a job driven model (ASAP) for a semiconductor wafer fabrication facility. They describe the differences in the model approaches and contrast run time of ASAP model to a SIGMA model (SIGMA faster).

258. Roeder, T., N. Govind, and L. Schruben., 2004, "A Queueing Network Approach To Semiconductor Automated Material Handling Systems: How Much Information Do We Really Need?," *Proceedings of the 2004 Winter Simulation Conference*.

Roeder, Govind, and Schruben (2004) present the use of a queuing network in place of a more detailed model to save time and reduce errors. They present that the greater the detail the more difficult to develop and greater chance of errors. In place of explicit information on each transporter, time in queues is used. Development time went from several weeks to several days. Both explicit system and queuing network modeled in Sigma. Results from approximation are similar to full model

259. Roeder, T. M. K., 2004, "An information taxonomy for discrete event simulations", *PhD Dissertation University of California, Berkeley*

Roeder' (2004) in her dissertation deals with DES taxonomy and information usage in the DES model. She compares alternative DES simulation programming languages (SPL) by the way and method they handle information. It is her assertion that execution rate for DES SPL's is effected by how much information the SPL's handle. Including extra information beyond what is needed for the particular study being performed can slow down execution.

In addition she contrasts DES taxonomy's based on the information handling of the languages (Resource-Driven and Job-Driven). In Resource-driven simulation

the focus is on the resident entities in the model. For Job-driven simulation the focus is on the transient entities in the model. She also compares the information taxonomy with the classical World Views. The worldview approach describes SPL implementation but not how information is handled. Her Taxonomy deals with information flow or how the SPL works and not how it represents the models. Roeder's main work is on information handling, and she presents a method to examine what information is needed in different simulation approaches. The purpose is to reduce excess information and thus memory usage. Roeders's dissertation did not provide specific examples showing this concept. If there is a significant difference, similar models that use different amounts of storage should have different run times.

260. Rossetti, M. D. and G. M. Clark, 2003, "Estimating operation times from machine center arrival and departure events," *Computers & Industrial Engineering*, Volume 44, Issue 3, March 2003, Pages 493-514

Rossetti and Clark (2003) show using actual data collected from shop floor and then alternatives tested by DES to improve operation. Accuracy of estimates are tested by the DES before floor trials

261. Runciman, N., 2001, "A Preliminary Study Of Tramming Speeds In Multiple Tele-Operated Load-Haul-Dump Scenarios Using Quest," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Runciman (2001) presents a model of an underground load/haul/dump operation created using a DES (QUEST) to evaluate alternative operating conditions. Using operational data, manufactures information, other sources an LHD system was created, verified and validated. Alternative experiments were running varying operating conditions; Speed and Control method. He determined that operating speed was not the overriding issue in production, faster speed lead to longer wait times, end result no increase.

262. Sanchez, S. M., 2001, "ABC's of Output Analysis," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Sanchez (2001) presents an overview of basic validation procedures for a simulation. She uses three basic steps

- A: Preparing for analysis
- B: Basic techniques
- C: Communicating to the user

Based on validating that the simulation produces valid results by statistical analysis.

263. Saraph, P. V., 2002, "Capacity Analysis Of Multi-Product, Multi-Resource Biotech Facility Using Discrete Event Simulation," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Saraph (2002) describes the use of a discrete event simulation for studying the capacity constraints of a manufacturing plant. He presents the steps in developing the model and why they felt it was an improvement over previous methods. The model was developed as a scheduling tool and used to identify constraints under stochastic conditions. The model looked at both current and potential future conditions. He uses SIGMA

264. Sargent, R. G., 1997, "Modeling *Queueing Systems* using hierarchical control flow graph models," *Mathematics and Computers in Simulation* Volume 44, Issue 3, October 1997, Pages 233-249

Sargent (1997) describes the use of hierarchical control flow graphs for DES. He describes what control flow graphs are and how they work and then describes how a hierarchical system would be structured with an overview. He describes how the HCFG would be used in a queuing system and provides examples of how they would be used. He describes a system (Hi-MASS) based on this concept

265. Sargent, R. G., 2001, "Some Approaches And Paradigms For Verifying And Validating Simulation Models," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Sargent (2001) discusses the topic of how to verify and validate a simulation model. He states that V&V needs to be done based on what the simulation was developed for. He discusses basic approaches for determining if it is valid

- Subjective: development team determines that it is valid
- User: team and user determine that it is valid (partially subjective)
- Independent: a third party, not related to developer or user determines that it is valid
- Scoring model: based on pre-determined passing scores for various parts

He presents two views on V&V: simple and complex for V&V based on end use and discusses statistical methods for V&V using some examples (treat V&V like an experiment on a real system)

266. Sargent, R. G., K. Kang and D. Goldsman, 1992, "An Investigation Of Finite-Sample Behavior Of Confidence Interval Estimators," *Operations Research*, Sep/Oct92, Vol. 40 Issue 5, p898, 16p;

Sargent, Kang, and Goldsman (1992) present establishing the reliability of the results from confidence interval estimators. Their work is related to V&V

267. Sarjoughian, H. S., and R. K. Singh, 200x, "Building Simulation Modelling Environments Using Systems theory and software Architecture Prinicpals," *Military Government and Aerospace Simulation Symposium*

Sarioughan and Singh (200x) discuss the importance of verification and validation without using those specific phrase. They presents the importance of model accuracy and reliability. They use the DEVSJAVA (java based discreet event simulator) as an example. Conclude that V&V begins with the selection of the model theory and system architecture.

268. Schafrik, S. J., 2001, "A New Style Of Simulation Model For Mining Systems," *Master's Thesis Virginia Polytechnic Institute and State University*, September 2001

Schafrik (2001) describes a GUI simulation system (WebConSim) for bulk material handling in an underground environment. The system is a GUI version based on the structure of ConSim. He begins with a general discussion on the development of mining simulation and provides an overview of stochastic issues and decision support systems in the mining environment. He provides a discussion of the proposed system and its organization and structure and provides case studies of its use

269. Schmeiser, B. W., 1982, "Batch Size Effects in the Analysis of Simulation Output", Operations Research, 30(3),556-568, 7 citations

Schmeiser (1982) continues the work of Law and Carson (1979) with emphasis on choosing the actual batch size. He uses batching to compute confidence intervals on the mean by transforming correlated observations into effectively uncorrelated and near normal distribution. Using the following assumptions

i) Initial transient effects have been removed.
ii) For a run length of n, the existence of a number of batches k* and associated batch size m* = n/k* such that dependency and the normality of the batch means are negligible, and
iii) The problem of *n/k** not being an integer is insignificant.

Schmeiser (1982) further strengthens ii to be:

ii) For a run length of *n*, there exists a number of batches *k*>= 2* and associated batch size *m* = n/k** such that for all *k <= k**, or equivalently for all *m >= m**, the dependency and the normality of the batch means are negligible.

Schmeiser (1982) reports that when using batching to reduce the number of data points, and to convert correlated data to semi-uncorrelated data with near normal distributions, selecting the proper batch size is important. He reviews the theory of batch size selection to determine the appropriate size and the appropriate number of batches. He examines the impact on the moments of the half width to the batch size (inversely proportional) and examines the impact of the coverage of the mean by the batch size (decreases as the number of batches increases, decreases as the value of alpha increases, is small when sigma is < 1). Implications:

1) the run must be long enough to provide the desired accuracy,
2) the run must be long enough to calculate a valid confidence interval,
3) smaller number of batches will often more easily satisfy normality and independence In general: 10<=k<=30 will satisfy most experiments.

In his title and write-up Schmeiser consistently refers to batch size *m where m= n/k*, *k* = number of batches, and *n* = total number of points. He actual uses *k* and infers *m*. His results are reported based on *k*.

270. Schriber, T. J. and D. T. Brunner, 2004, "Inside Discrete-Event Simulation Software: How It Works And Why It Matters," *Proceedings of the 2004 Winter*

Simulation Conference R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Schriber and Brunner (2004) present an overview of DES, how DES works and what the parts are. They explain the main components of DES model and presents how it works in: AutoMod, SLX, Extend. They discuss differences between SIMAN, ProModel (Version 3), GPSS/H, AutoMod, SLX, and Extend.

271. Schroer, B. J. and F. T. Tseng, 1988, "Modelling complex manufacturing systems using discrete event simulation," Computers & Industrial Engineering, Volume 14, Issue 4, 1988, Pages 455-464

Schroer and Tseng (1988) prsent a concept (early) for reusable components in developing a simulation model. Using GPSS/PC they develop some standard manufacturing units and then show reusing them to create new models of different systems.

272. Schruben, L. W., 1982, "Detecting Initialization Bias in Simulation Output," *Operations Research*, Vol. 30, 1982, pp. 569-590.

Schruben (1982) presents a procedure based on the asymptotic convergence of partial sums of deviations about the average to a Brownian bridge process. This procedure is also based on the central limit theorem. The procedure assumes that there are two parts simulation output: "signal" and "noise". The "noise" is a random portion due to normal conditions. The "signal" is due to any changes in average conditions. If no initialization bias is present then the "signal" would remain constant through the run. If bias is present the "signal" would change over time.

273. Schruben, L. And T. Roeder., 2003, "Fast Simulations of Large-Scale Highly Congested Systems," to appear in Simulation: *Transactions of the Society for Modeling and Simulation International*

Schruben and Roeder (2003) Presents the concept that event graph simulation models maybe inherently faster than other approaches.. They describe various types of DES approaches and how they describe jobs and resources. They reviews the differences between resource driven and job driven and event graph versus process interaction, and compares a resource driven and job driven approach for information generated. They show how to gain most of the information from a job driven approach in a resource driven approach. They presents an approach to achieve a job driven result using an event graph approach than a process interaction model.

274. Schruben, L. W., T. M. Roeder, W. K. Chan, P. Hyden, and M. Freimer, 2003, "Advanced Event Scheduling Methodology," *Proceedings of the 2003 Winter Simulation Conference* S. Chick, P. J. Sánchez, D. Ferrin, and D. J. Morrice, eds.

Schruben, et al. (2003) discusses advanced procedures to increase the information gained from a simulation without increasing the complexity of the model. They describes the theory and structure of simulation event graphs and presents four methods to collect additional information from a simulation

- simultaneous replications and time dilation
- infinitesimal perturbation analysis
- math programming
- estimating rare event behavior.

Simultaneous replications and time dilation uses multiple parallel replications by changing the meaning of the internal clock. Infinitesimal perturbation analysis allows estimating response gradients with a single run. Math programming is a method to use a SEG as a linear programming model. Estimating rare event behavior uses probability to estimate waiting time without tracking individual jobs, uses recourse driven instead of job driven.

275. Seila, A. F., 2004, "Spreadsheet Simulation," *Proceedings of the 2004 Winter Simulation Conference* R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds.

Seila (2004) presents the use of a spreadsheet for simulations, primarily for continuous analysis. He presents the features found in most spreadsheets that allow for stochastic modeling and creating simulation experiments. His presentation does not cover discrete event simulation, and specifically explains why he does not feel it is practicable. His methods are geared for data analysis and review type simulations.

276. Semini, M., H. Fauske, and J. Strandhagen, 2006, "Applications of Discrete-Event Simulation to Support Manufacturing Logistics Decision-Making: A Survey," *Proceedings of the 2006 Winter Simulation Conference,* L. F. Perrone, F. P. Wieland, J. Liu, B. G. Lawson, D. M. Nicol, and R. M. Fujimoto, eds.

Semini, Fauske, and Strandhagen (2006) present a survey of recent WSC papers dealing with DES for manufacturing logistics DSS. They report on 52 papers of which several reported on the combination of DES with optimization. The major industries reporting on the use of DES in logistics were semiconductor (13) and automotive (10). Arena (13) and Automod (11) were the two most used SMP. Five papers described a combined simulation and optimization methods. Two dealt with using DES to calculate objective function values in heuristic algorithms (Shanthikumar and Sargent (1983) Type III); one estimated queuing times and slack repeatedly in an iterative scheduling algorithm (Type I); one identify bottlenecks in a bottleneck-based scheduling algorithm (Type II); and one used DES to assess the performance of a flow shop schedule created by a scheduling heuristic (not truly hybrid). Four of these were short term planning and scheduling. They conclude that optimization has a greater potential to support DES in operational planning processes rather than strategic decision-making.

277. Seong Y.R. T.G. Kim and K.H. Park, 1995, "Mapping hierarchical, modular discrete event models in a hypercube multicomputer," *Simulation Practice and Theory*, Volume 2, Issue 6, 15 May 1995, Pages 257-275

Seong, Kim and Park (1995) discuss using PDES on a type of multi processor computer (hypercube). They describe how the PDES, using the DEVS formalism, would be used on a hypercube computer.

278. Shanthikumar, J. G. and R. G. Sargent, 1983, "A Unifying View of Hybrid Simulation/Analytic Models and Modeling," Operations Research, Vol. 31, No. 6, Simulation (Nov. - Dec., 1983), pp. 1030-1052

Shanthikumar and Sargent (1983) describe four (4) types of hybrid systems combining analytical portions and simulation portions.

- I: Results are obtained by alternating between independent analytical and simulation models; after the solution for each is derived the solutions are then combined for an overall solution.
- II: An analytical and simulation model operate in parallel and their output is compared together.
- III: A simulation model is used to feed an analytical model.
- IV: An analytical model is used to feed a simulation model.

Analytical models can be lower in development cost then simulations are usually low in cost to run once developed. Simulation models give more detail are usually more realistic. Combining them can give strong benefits of both. Type I or II are used if the time dependent nature of the system can be broken out, with type I being used if the time dependent nature can be completely separated and type II if their is some interdependency. These types are also used when the simulation model is used for validating the analytical models output. Type III is used when a simulation of system or subsystem is used to determine some or all of the values used in the analytical model. Type Iv is used when an analytical model is used to determine some or all of the inputs for the simulation.

279. Shao, X., X. Li, L. Gao, and C. Zhang, 2009, "Integration of process planning and scheduling—A modified genetic algorithm-based approach," Computers & Operations Research, Volume 36, Issue 6, June 2009, Pages 2082-2096

Shao, et al. (2009) present a study using integrated process planning and scheduling to work towards a computer integrated manufacturing system (description approaches a decision support system). They present that the traditional approach separated scheduling and planning with scheduling being done after the plan had been developed. They show how improved plans and schedules can be developed if an integrated approach is followed. They propose to use a genetic algorithm to iterate to an optimization point. They do look at alternative schedules impact on the optimization, but do not include a simulation module.

280. Sharp, G. P., Y.-T. Wan, L. F. Mcginnis, M. Goetschalckx, D. A. Bodner, T. Govindaraj, B. Ram and J. Everette., 2001, “A Structured Approach to Material Handling Systems Selection and Specification for Manufacturing,,” *Proceedings of the 2001 Industrial Engineering Research Conference*, Dallas, TX, 2001.

Sharp, et al. (2001) describe the development of an expert system to assist in selection of a material handling system. They presents the criteria for the expert system and explains how to approach the problem

281. Shi, J. J., 2002, "Practical Approaches For Validating A Construction Simulation," *Proceedings of the 2001 Winter Simulation Conference* B. A. Peters, J. S. Smith, D. J. Medeiros, and M. W. Rohrer, eds.

Shi (2002) describes three methods to validate a DES simulation

- Tracing the simulation progress
- Checking the operation of the activities
- Checking the operating cycles

He discusses what is involved with verifying and validating a simulation, and describes two alternative approaches (black box and white box) and the pros & cons of each

- Black box compares i/o with real world system, ignoring how the input is converted to output
- White box analyzes how the input is used to generate the output.

He uses a concrete batch operation for explanation of the methods, and presents that the white box approach with alternative methods is best.

282. Shi, J. J., 2003, "Simulation self-diagnoses," *Automation in Construction* Volume 12, Issue 4, July 2003, Pages 419-430

Shi (2003) discusses simulation V&V for construction simulations. For several construction DES' (CYCLONE, UM-CYCLONE, STROBOSCOPE, SYMPHONY). He describes typical V&V issues

283. Silver, G. A., L. W. Lacy and J. A. Miller, 2006, "Ontology Based Representations of Simulation Models Following the Process Interaction World View, " Proceedings of the 37th conference on Winter simulation, 2006, Monterey, California December 03 - 06, 2006, Pages: 1168 - 1176

Silver, Lacy, and Miller (2006) describe the development of ontologies for DES, with specific orientation towards the work by University of Georgia (Discrete Event Model Ontology (DeMO)) and University of Florida (Web Ontology Language (OWL)). While others have stated or implied that the Worldviews are at the taxonomy level, this paper (work by Lacy) implies that worldviews are separate from the taxonomy/ontology concept (note: I disagree with this and prefer to think of worldviews as one of alternative taxonomy structures). The paper then presents an "ontology for the Process Interaction worldview, based on the use of DeMO.

284. Simmons, L. F., 2002, "Project Management – Critical Path Method (CPM) And Pert Simulated With Processmodel," *Proceedings of the 2002 Winter Simulation Conference* E. Yücesan, C.-H. Chen, J. L. Snowdon, and J. M. Charnes, eds.

Simmons (2002) presents the use of ProcessModel to simulate a CPM/Pert chart. He gives an example of using a DES (Process Model) for scheduling.

285. Sims, M. J., 1997, “An Introduction To Planning And Scheduling With Simulation,” *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Sims (1997) presents using DES for scheduling, and gives some general examples from manufacturing and service.

286. Siprelle, .A. J. and R. A. Phelps, 1997, “Simulation Of Bulk Flow And High Speed Operations,” *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Siprelle and Phelps (1997) presents the development of a bulk handling model for filling consumer products (packages and bottles). Uses SDI Industry on top of Extend + Manufacturing. They describes the development of the model and the different levels of viewing.

287. Small, C. T., 2005, “An enterprise knowledge-sharing model: A complex adaptive systems perspective on improvement in knowledge sharing,” *Ph.D. dissertaion George Mason University*

Small (2005) in her dissertation presents the area of knowledge sharing (KnS) as part of a CAS system. She presents the impact of knowledge sharing on an organization and its competitiveness. Her main thesis being that proper knowledge management (KM) is based considered as a CAS structure and the application of CAS theory to KM and particular KnS is critical.

288. Sörensen, K., and G. K. Janssens, 2004, “Automatic Petri Net Simulation Model Generation for a Continuous Flow Transfer Line with Unreliable Machines,” *Quality and Reliability Engineering International* Volume 20, Issue 4, Date: June 2004, Pages: 343-362

Sörensen and Janssens (2004) present an example of using Petri nets for a series workflow with queues. They describes the creation and use of a simulation model of a machine shop using Petri nets and how to turn the PN into a simulation

289. Stevenson, D. E., 2003, “Research Issues in Verification and Validation from Foundations'02.,” *Proceedings of SCSC ‘03*. San Diego: SCS. 2003

Stevenson (2003) provides an overview of the Foundations '02 conference on V&V and highlights the topics covered, what is currently considered important. Cost effectiveness and relating the V&V to the scope of the project were important.

290. Sturgul, J. and K. Prisbrey,, 2001, “Combined Discrete Event and Continuous Transfer Function for Processing Flowsheets,,” *Third Internat’l. Conference on Intelligent Processing and Manufacturing of Materials*. July, Vancouver, B.C. Published on CD.

Sturgul and Prisbev (2001) Presents a hybrid system of a DES and a continuous model for modeling flowsheets.. They describes the advantages and disadvantages of each (DES and continuous)

- DES works well in scheduling the operation and checking for material through put, but does not work on evaluating any physical/chemical changes (size reduction, etc.)
- Continuous models can predict the physical/chemical changes but do not work as well on the scheduling and discrete events.

They combine GPSS/H and Matlab to function as a hybrid system.

291. Suri, R. and R. Desiraju, 1997, "Performance Analysis of Flexible Manufacturing Systems with a Single Discrete Material-Handling Device," *International Journal of Flexible Manufacturing Systems*, volume 9 issue 3: pp223-249, July 1997

Suri and Desiraju (1997) present a semi-analytical approach for FMS and material handling system. By using two algorithmic models, one for the FMS and the other for the material handling and iterating they claim results similar to a DES approach.

292. Swain, J. J., 2003, "Simulation Reloaded: Simulation Software Survey," *ORMS* August 2003 • Volume 30 Number 4

Swain (2003) provides a review of discrete event simulation software currently in use. He describes features, and changes from previous version and provides contacts and pricing

293. Sysi-Aho, M. T., 2005, "A game perspective to complex adaptive systems," *D.Sc.(Tech) dissertation Teknillinen Korkeakoulu (Helsinki) (Finland)*

Sysi-Aho (2005) in his doctoral project presents the use of games to analyze CAS functions in societies as agent based models. He uses both minority games (MG) (The game consists of N-agents who decide between two alternatives, A or B. Those who belong to the minority, win.) in which the interest is focused on self-organization in a population of agents with limited capabilities when they compete for scarce resources. And in spatial two-player games which consists of spatially structured populations that are composed of individuals who can repeatedly interact with each other.

294. Taha, A. H., 1997, "Software to support dynamic Q-analysis," *Ph.D. dissertation New Mexico State University*,

Taha's (1997) dissertation presents a Software package (C/C++) to support dynamic Q-analysis. Q-Analysis (Atkin 1974) is a geometrically oriented approach to exploring and representing structure in data, mapping relations among finite sets. It draws on the topology of simplices and simplicial complexes and produces measures as well as graphs; it shares characteristics of both cluster analysis and network analysis. Taha presents the how the use of Q-analysis for evaluating complex systems can be improved by software (C/C++) package doing the analysis.

295. Tofts, C., 1998, "Exact, analytic, and locally approximate solutions to discrete event-simulation problems," *Simulation Practice and Theory*, Volume 6, Issue 8, 15 December 1998, Pages 721-759

Tofts (1998) describes the use of process algebra can be used to perform DES. His approach is to use process algebra as an ontology to describe the DES and then use it to solve the problem. He also presents that by this approach a near hybrid solution can be achieved. His proposes that his approach retain the decomposable features of standard DES while adding the analytical features often associated with a hybrid approach. Tofts calls his system weighted synchronous calculus of communicating systems (WSCCS) and states that his process algebra consists of essentially four components:
(1) a syntax for presenting process expressions, based on a notion of activity or action;
(2) an operational semantics, describing how terms can be interpreted as automata;
(3) a congruence1 demonstrating when two automata can be considered equivalent in all contexts;
(4) an equational theory, based on the congruence, which defines how the equivalence on automata is demonstrated at the level of syntactic terms.
He presents an example and contrasts it with DEMOS (Britwistle and Tofts (1997) and Britwistle and Tofts (2001)).

296. Trinkaus, H. L. and T. Hanne, 2005, "knowCube: a visual and interactive support for multicriteria decision making," Computers & Operations Research, Volume 32, Issue 5, May 2005, Pages 1289-1309

Trinkaus and Hanne (2005) describe their work on KnowCube an effort to make multicriteria decision support system (MCDSS) easy to use for non-specialist (make anyone a multicrieaia decision maker)MCDM)). KnowCube is organized in modules with the user primarily dealing worth the generation and navigation modules.

- KnowCube
  - KnowOrg (knowledge organization)
    - KnowBlo (block)
    - KnowBas (base)
    - KnowMet (metric)
    - KnowSto (storage)
  - KnowGen (knowledge generation)
    - KnowOpt (optimization)
    - KnowExp (experiments)
    - KnowSim (simulation)
    - KnowImp (import)
  - KnowNav (knowledge navigation)
    - KnowVis (visualization)
    - KnowSel (selection)
    - KnowDis (display)

The actual analysis is done using radar plots (spider web) for visualization and selection.

297. Tzafestas, S. G. and G. G. Rigatos, 2000, “Stability analysis of an adaptive fuzzy control system using Petri Nets and learning automata,” *Mathematics and Computers in Simulation* Volume 51, Issues 3-4, January 2000, Pages 315-339

Tzafestas and Rigatos (2000) use of Petri nets as part of a control system

298. Vaidyanathan, B. S., D. M. Miller, and Y. H. Park, 1998, “Application Of Discrete Event Simulation In Production Scheduling,” *Proceedings of the 1998 Winter Simulation Conference* D.J. Medeiros, E.F. Watson, J.S. Carson and M.S. Manivannan, eds.

Vaidyanathan, Miller, and Park (1998) present the examination of a coffee roasting and packaging operation using SIMAN. The alternative schedules for each of the operating stages were evaluated using DES with the goal to improve utilization while meeting delivery requirements.

299. Van Beek, D.A., J.E. Rooda, and S.H.F. Gordijn, 1995, “A Combined Continuous-Time Discrete-Event Approach to Modelling and Simulation of Manufacturing Machines,” *Proceedings of the 1995 EUROSIM Conference*, Vienna, Sept. 1995, pp. 1029–1034.

Van Beek, Rooda, and Gordijn, (1995) presents Chi, a simulation language that can handle both discreet and continuous events. They describe the structure of the language and how it functions. Continuous events handled by differential algebraic equations while discrete events are handled as communication sequential processes. All data is handled by the connectors called channels. The structure seems to be similar to Sigma, but open sourced, it appears to be based on an upgrade of Petri Nets.

300. Van Beek, D. A., S. H. F. Gordijn and J. E. Rooda, 1997, “Integrating continuous-time and discrete-event concepts in modelling and simulation of manufacturing machines,” *Simulation Practice and Theory*, Volume 5, Issues 7-8, 15 October 1997, Pages 653-669

Van Beek, Gordijn and Rooda (1997) review of Chi language for hybrid DES for simulating control systems. They use an example of a conveyor line and presnt a discussion of the control system (repeat of 1995 paper).

301. Venkateswaran, J., 2005,"Production and distribution planning for dynamic supply chains using multi-resolution hybrid models," *PhD dissertation University of Arizona*

Venkateswaran (2005) in his dissertation presents a method of planning and scheduling across a hierarchical organization using a hybrid simulation method. He differentiate between planning and scheduling as planning being a strategic level (longer term) efforts, and scheduling (short term) being a tactical or shop floor level function. He proposes that the overall system is tiered feedback loop system and thus uses a System Dynamics approach with an integrated DES for modeling the performance. He also uses a two tiered DES model, one for the enterprise and one for the shop floor.

302. Venkateswaran, J., Y. Son; and A. Jones, 2004, “Hierarchical production planning using a hybrid system dynamic-discrete event simulation architecture,” *Proceedings of the Winter Simulation Conference* (Washington, D.C.), R .G. Ingalls, M. D. Rossetti, J. S. Smith, and B. A. Peters, eds. , Volume 2, Issue , 5-8 Dec. 2004 Page(s): 1094 - 1102 vol.2

Venkateswaran, Son and Jones (2004) present a method of planning and scheduling across a hierarchical organization using a hybrid simulation method (work based on research for Venkateswaran’s dissertation (Venkateswaran (2005)).

303. Venkateswaran, J, and Y. Son, 2005, "Hybrid System Dynamic--Discrete Event Simulation-based Architecture for Hierarchical Production Planning," *International Journal of Production Research,* 43(20), 4397-4429.

Venkateswaran and Son (2005) use a three stage system to model multi-plant system. Individual plants are modeled using a DES (Simple++), a perfomance monitor and an optimizer level. Plant groupings are modeled using a analytical model or system dynamics apporach (SAM) also with a performance monitor and optimizer component. Overal tools are based on the IDEF concept. Functional modeling uses IDEF0, and process modeling IDEF3. Both the individual DES models and the system klevel SD models interact. The hierachrial system consists of the Optimizer, Performance Monitor and Simulator modules at each decision level. The optimizers select the optimal set of control parameters based on the estimated behaviour of the system. The enterprise-level simulator (SD model) and shoplevel simulator (DES model) interact with each other to evaluate the plan. Feedback control loops are employed at each level to monitor the performance and update the control parameters.

304. Van Halderen, B. A. W., and B. J. Overeinder, 1998, “Fornax: Web-based distributed discrete event simulation in Java,” *Concurrency: Practice and Experience* Volume 10, Issue 11-13, Date: September November 1998, Pages: 957-970

Van Halderenand Overeinder (1998) present a Java based PDES system based on Perl (GPL). They present an example using alternative clock methods.

305. Vern, K. and A. Gunal, 1998, “The Use Of Simulation For Construction Elements Manufacturing,” *Proceedings of the 1998 Winter Simulation Conference* D.J. Medeiros, E.F. Watson, J.S. Carson and M.S. Manivannan, eds.

Vern and Gunal (1998) present the use of simulation (Promodel) in evaluating a pre-cast concrete construction operation. The simulation is used to evaluate alternatives in the process: form length; alternative scheduling strategies; alternative crew scheduling; impact on productivity by automating; labor distribution, layout, and material flow for an alternative process; and resource utilization (labor, yard trucks, cranes, etc.). A case study was presented showing the application, and they present that improved production is possible.

306. Wainer, G. A., 2002, “CD++: a toolkit to develop DEVS models," *Software: Practice and Experience,* Volume 32, Issue 13, Pages 1261 - 1306

Wainer (2002) presents a toolkit (CD++) for the development of DES models following the DEVS and Cell-DEVS formalisms. While different components are used depending on the platform Windows, Linux, AIX, IRIX, HP-UX and Solaris) a GUI based on Java and VRML is included. A stated goal is to allow construction of models quicker and with greater reusability by breaking the model into sub-models (called atomic levels). He claims that alternative simulation approaches (such as Petri nets, FSM, cellular automata, VHDL or timed graphs).

307. Wainer, G. A. and N. Giambiasi, 2002, "N-dimensional Cell-DEVS Models," *Discrete Event Dynamic Systems*, volume 12 issue 2: pp 135-157, April 2002
Wainer and Giambiasi (2002) present an extension to Cell-DEVS model to allow for more than two dimensions. Results are conceptual similar to computational fluid dynamics, but based on DES. They use of a DES on a cellular model for a generic approach to a hybrid solution.

308. Wakeland, W. W., R. H. Martin, and D. Raffo, 2004, "Using design of experiments, sensitivity analysis, and hybrid simulation to evaluate changes to a software development process: a case study," *Software Process: Improvement and Practice* Volume 9, Issue 2, Date: April/June 2004, Pages: 107-119
Wakeland, Martin and Raffo (2004) present an application of Industrial engineering principles to analysis of a hybrid simulation. They show the scheduling of a software project by use of hybrid simulation. They use DOE and sensitivity analysis of scheduling example.

309. Wen, C., 1998, "Modeling problems of hybrid event dynamic systems," *Simulation Practice and Theory*, Volume 6, Issue 4, 15 May 1998, Pages 413-422
Wen (1998) presents a theoretical review of hybrid event dynamic systems and their modeling problems. He reviews various types of simulations system and presents the relationship between the systems. He provides the mathematical models of the systems

310. Williams , E. J. and I. Ahitov, 1996a, "Scheduling Analysis Using Discrete Event Simulation*," Proceedings of the 29th Annual Simulation Symposium*, 148-154.
Williams and Ahitov (1996a) present the development of a simulation model for simulating the operating schedule of a proposed machine shop. The model was used to determine shop production rate and potential bottlenecks. Analysis of the results determined some modifications that would improve throughput. Changeovers (run lengths) were modified based on results. They originally thought that one day runs were optimal, study showed that two-day runs out performed one day runs. Uses Arena

311. Williams , E. J. and I. Ahitov., 1996b, "Integrated Use of Macro and Micro Models Within a Simulation Study*," AUTOFACT '96 Conference Proceedings*, ed. Lisa Moody, 169-179.
Williams and Ahitov (1996b) Presents the use of simulation for process improvement, they discuss both the macro and micro issues in using a simulation

for optimization. An automotive assembly system is used for example. Uses Arena and Siman

312. Williams, E. J. and R. Narayanaswamy, 1997, “Application Of Simulation To Scheduling, Sequencing, And Material Handling,” *Proceedings of the 1997 Winter Simulation Conference* ed. S. Andradóttir, K. J. Healy, D. H. Withers, and B. L. Nelson

Williams and Narayanaswamy (1997) present the use of AutoMOD to develop a scheduling and planning tool. Three different crane choices were evaluated to determine which could meet the desired schedule. Production rate, material delivery, and delivery sequence were studied.

313. Willis, K. and D. Jones, 2008, " Multi-objective simulation optimization through search heuristics and relational database analysis," *Decision Support Systems* (2008), doi:10.1016/j.dss.2008.06.012

Willis and Jones (2008) use a heuristic search algorithm with a simulation model coupled to a database for their analysis. They present SimMOp as a framework for optimization. They describe SimMOp as a simulation model, a non-exhaustive heuristic search algorithm with an embedded multi-objective optimization technique, and database technologies. Their initial description and figures indicate an iterative process, but their flowchart seems to show only one pass through the simulation model.

314. Woodward, E. E. and G. T. Mackulak, 1997, “Detecting logic errors in discrete-event simulation: reverse engineering through event graphs,” *Simulation Practice and Theory*, Volume 5, Issue 4, 15 May 1997, Pages 357-376

Woodward and Mackulak (1997) discuss a concept (reverse engineering) for validating a DES. They describe the basic methodology of reverse engineering, based on event graphs simulation. They gives examples using several different languages (SLAM, SIGMA, GPSS, SIMAN) (concentrates on SLAM)

315. Wu, P., S.C. Fang, R.l E. King, and H. L. W. Nuttle, 1994, “Decision Surface Modeling of Apparel Retail Operations using Neural Network Technology,” *Proceedings of IEEE 1994 Textile, Fiber, and Film Industry Conference*

Wu, et al. (1994) present the application of simulation with AI aspects for a quick response system in apparel manufacturing. They use a nueral network approach to select between results from the simulation.

316. Wu, Y., 2004, “On fast simulation techniques for queueing systems,” *Ph.D. dissertation University of Massachusetts Amherst*,

Wu's (2004) dissertation evaluates causes of errors and slow execution of communications simulators, with the goal of improving speed and accuracy for simulations. He notes that a major cause of error is when the queue is empty. He proposes a method of time management called compensated time stepped simulation (CTSS) to improve both. In his analysis he examines problems with purely analytical simulations (over simplification) and with DES (large amount of

data (track each packet at each node)). PDES is a potential solution but it has additional hardware and system overhead requirements. His system combines features of all.

317. Yan, X. G., J. Lam, H. S. Li, and I. M. Chen, 2000, "Decentralized Control of Nonlinear Large-Scale Systems Using Dynamic Output Feedback," *Journal Of Optimization Theory And Applications*: Vol. 104, No. 2, pp. 459–475, FEBRUARY 2000

Yan, et al. (2000) present using a mathematical model of a large scale (theoretical) system to study the control of the system. They proposes a decentralized control system to improve performance, but using similar subsystems. They evaluate their procedure using a simulation model.

318. Young, J. S., A. T. Jones and R. A. Wysk, 2003, "Component based simulation modeling from neutral component libraries*1," *Computers & Industrial Engineering*, Volume 45, Issue 1, June 2003, Pages 141-165

Young, Jones, and Wysk (2003) present developing a simulation from pre-developed library components. By developing pre-made library components it should speed up simulation development.. They give examples using ARENA and ProModel and considers using the internet to allow interchange of components and software.

319. Yu, H., A. Reyesb, S. Cangc and S. Lloydd, 2003, "Combined Petri net modelling and AI based heuristic hybrid search for flexible manufacturing systems—part I. Petri net modelling and heuristic search —part II. Heuristic hybrid search," *Computers & Industrial Engineering*, Volume 44, Issue 4, April 2003, Pages 527-543(part I), & Pages 545-566(Part II)

Yu, Reyesb, Cangc, and Lloydd (2003) present a two part paper on Petri nets and heuristic hybrid modeling. Part I is a review of Flexible Mfg System, and Petri net modeling of FMS. They describe FMS modeling language (FmsML) and of using heuristic loop and PN for scheduling.. Part II goes into further detail on heuristic loop and search, and presents an example results for proposed system

320. Yurtsever, T. and N. G. Pierce, PE, 1998, "Computerized Manufacturing Monitoring and Dispatch System," *Computers & Industrial Engineering* Vol. 35, Nos 1-2, pp. 137-140, 1998

Yurtsever and Pierce (1996) describe Motorola's Graphical Manufacturing Monitoring System. The system uses a DES to help schedule work. It uses inputs from current operating data to a DES to optimize the production schedule based on current actual information. They present that its use improved through put by 20%

321. Zarei, B. and M. Pidd, 2001, "Performance analysis of automatic lookahead generation by control flow graph: some experiments," *Simulation Practice and Theory*, Volume 8, Issue 8, 15 July 2001, Pages 511-527

Zarei and Pidd (2001) review the problems and advantages of using look ahead to synchronize PDES. They examines control flow graphs and how to use look ahead generates. They postulates that properly programmed look ahead generators work well. They discuss alternative generates and present an example of using a generator versus manual method.

322. Zeng, Q., and Z. Yang, 2009, "Integrating simulation and optimization to schedule loading operations in container terminals," *Computers & Operations Research*, Volume 36, Issue 6, June 2009, Pages 1935-1944

Zeng, and Yang (2009) present the use of a hybrid system for scheduling loading operations in container terminals. They use genetic algorithm and a simulation model (developed in Arena). As with many other examples (Schruben (2008)) the majority of their article is related to the GA with only four paragraphs on the simulation model, and no discussion of the actual model. The actual hybrid concept is fairly standard with an internal and external iterative loop. As with Byrne and Bakir (1999), Kim and Kim (2001), and Byrne and Hossain (2005) the hybride solution produced good results.

323. Zerhouni,N., M. Ferney and A. El Moudni, 1995, "Transient analysis of manufacturing systems using continuous Petri nets," *Mathematics and Computers in Simulation* Volume 39, Issues 5-6, 30 November 1995, Pages 635-639

Zerhouni, Ferney and El Moudni (1995) present modified Petri nets called variable continuous Petri net: (VCPN). This is an early work on using DES in a continuous role

324. Zhang, H. and H. Li, 2004, "Simulation-based optimization for dynamic resource allocation," *Automation in Construction*, Volume 13, Issue 3, May 2004, Pages 409-420

Zhang and Li (2004) present the use of a heuristic algorithm for optimization in a construction DES for a hybrid simulation concept. Their approach starts with a DES of a construction project and uses heuristic algorithms to reach an optimal solution and then uses this as input for further DES replicates. They present an example of their approach on a typical project. (Note this would be a type III (Shanthikumar and Sargent (1983)) approach.)

325. Zhu, X. and W. Wilhelm, 2005, "Scheduling and lot sizing with sequence-dependent setup: A literature review," *IIE Transactions* volume 38, pp 987–1007

Zhu and Wilhelm (2005) review literature to 2005 on sequence dependent scheduling problems. Of the 128 reference they reviewed only two used simulation methods for their primary approach (several used simulation to verify results) and none used a true hybrid approach.