Lecture

Performance Modeling of Computer Systems

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  - Multiprocessor-, Client Server-, Terminal-, Kommunication -, Operating- and Production Systems
◆ **Performance Evaluation Tools**
  - Queueing Network Tool **PEPSY** Performance Evaluation and Prediction SYstem
  - Markov Analyzer **MOSEL** MOdeling Specification and Evaluation Language

**References:**
◆ Bolch, G:
  Leistungsbewertung von Rechensystemen mittels analytischer Warteschlangenmodelle, Teubner, 1989, 311 pages
◆ Bolch, G., Greiner, S., de Meer, H. Trivedi, K.:
◆ Begain, K., Bolch, G., Herold, H.:
◆ Menasce, D., Almeida,V., Dowdy, L.:
  Capacity Planning and Performance Modeling, Prentice Hall, 1994, 412 pages
◆ Gelenbe, E. and Pujolle, G.:
  Introduction to Queueing Networks John Wiley & Sons, 1998, 244 pages