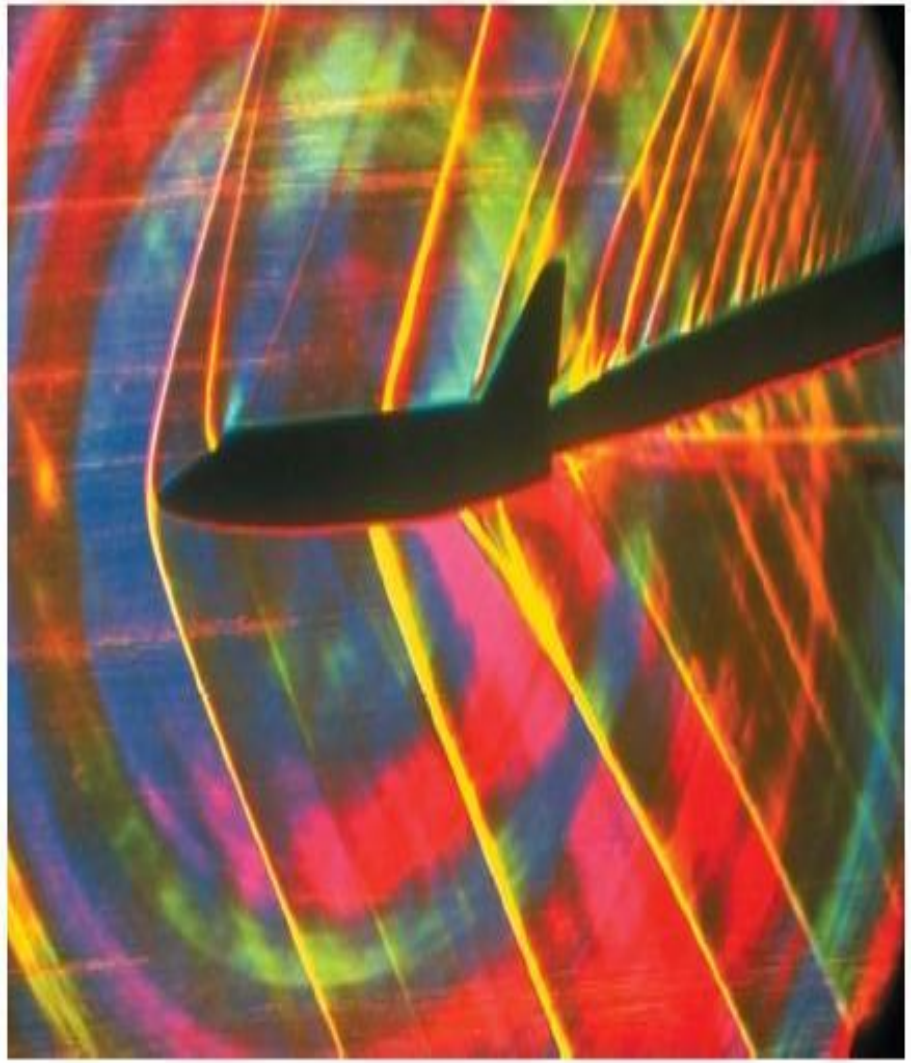
Amr Wassal

Modeling and Simulation

Computer Engineering

Cairo University

Fall 2021



Course Outline

- Introducing the Concepts
- Time Handling Mechanisms
- Discrete Event Simulation (DES)
  - General Principles
  - DES Case Study in SIMAN/Arena
- Continuous-Time Simulation
  - DAE Solvers
- Random Numbers
  - Usage, Generation, Validation, Pitfalls
- Queuing Systems

- Other Topics:
  - Mixed-Signal Simulation
  - Finite Element Modeling and Multi-physics (if time permits)

Intended Learning Objectives (ILOs)

1. Explain different concepts of Modeling & Simulation.
2. Apply the mathematical models employed in some of the commercial simulators like SPICE manually.
3. Interpret the general principles of discrete-event simulation.
4. Develop and simulate models for different systems using commercial tools like ARENA.
5. Illustrate how to generate different Random Variable distributions.
6. Understand the basics of queuing theory and its application in discrete event simulations.
7. Develop discrete event models for different real-life applications.
8. Assess the validity of model behavior and simulation results.
9. Identify system parameters and performance criteria to optimize and propose changes in real-life systems based on simulation results.

Course Requirements and Grading (Regular System)

- Subject to change

- Class work: 5% - individual effort
- Midterm: 10% - individual effort
- Final: 70% - individual effort
- Project: 15% - group effort

Target Course Weekly Plan

11/Oct		x	x		Introduction to modeling & simulation / Time Handling
18/Oct					Vacation
25/Oct			x		Discrete-event simulations
1/Nov		x	x		SIMAN & Review / Continuous time solvers
8/Nov			x		Continuous time solvers
15/Nov		x	x		Random numbers usage & generation
22/Nov			x		Random numbers usage & generation (cont.)
29/Nov		MIDTERM			
6/Dec		x	x		Queuing Systems
13/Dec			x		Queuing Systems (cont.)
20/Dec		x	x		Mixed Signal Simulations
27/Dec			x		1. Intro & data types and digital review (ch. 25, 1-5)
3/Jan		x	x		2. Analog modeling (ch. 6, 8) 3. Misc: Packages & parameterization, design process,… (ch. 7, 9-12, 15-17, 19-22, 24)
10/Jan		x	x		4. Freq & TF modeling (ch. 13-14) 5. Case study (RC Plane) (ch. 18, 23, 26)
			Lecture		
			VHDL-AMS Presentations (5 groups)		

Suggested References

1. “Simulation Modeling and Analysis with Expertfit Software,” Averill M. Law, 4th edition, McGraw Hill, 2006

2. “Simulation,” Sheldon Ross, Academic Press, 1996

3. “The Designer’s Guide to Analog & Mixed-Signal Modeling: Illustrated with VHDL-AMS and MAST,” R. Scott Cooper, Synopsys Inc., 2004

4. “Simulation with Arena,” W. David Kelton, Randall Sadowski, David Sturrock, McGraw-Hill, 2004

Suggested Presentation References

VHDL-AMS

- “The System Designer's Guide to VHDL-AMS: Analog, Mixed-Signal, and Mixed-Technology Modeling,” Peter J. Ashenden, Gregory D. Peterson, Darrell A. Teegarden, Elsevier (was Morgan Kaufman), 2002

FEM & Multiphysics

- “Introduction to Modelling of Multiphysics Problems,” Tomasz G. Zieliński, http://www.ippt.gov.pl/~tzielins/index.php?im=1&id=lectures.html
- “Finite Element Procedures,” Klaus-Jurgen Bathe, . Cambridge, MA, 2007.
- Many books on COMSOL…