ELEC5508 / ELG6358

Advanced Methods for Circuit Simulation

This course is intended for developers/users of CAD tools and circuit/system designers. The objective is to provide in-depth understanding of the fundamental basis of circuit theory as well as advanced simulation techniques. The applications of the covered topics span a wide spectrum of engineering fields.

Course Outline

State-Space Equations:
- Concept of states
- Time-invariant and time-variant circuits
- Dynamical equations
- State-transition matrix
- Periodic circuits

Circuit Properties:
- Frequency, time, and Laplace-domains
- BIBO and Asymptotic stability
- Lyapunov equations
- Multiport networks
- Passivity
- Causality
- Nonlinearity

Frequency-Domain Simulation:
- Modified-Nodal Analysis
- LU decomposition
- Sparse techniques

Time-Domain Simulation:
- Laplace and Fourier transforms
- Multi-step methods
- Numerical stability
- Complex analysis
- Cauchy Theorem
- Numerical Inversion of Laplace transform

Simulation of Nonlinear Circuits:
- DC Analysis
- Jacobian matrix
- Newton’s iterations
- Iterative time-stepping solution

Overview of Model-Order Reduction (MOR)
REFERENCES

(1) Computer Methods for Circuit Analysis & Design
(2) Electronic Circuit and Simulation Methods
(3) Circuit Simulation
(4) Linear and Nonlinear Circuits
(5) Linear System Theory
   W. Rught, Prentice Hall, 1996

+ Handouts

**Background Prerequisite**

Course Grading

50% Final Exam *(open book)*
50% Midterm Exams and Assignments

*Passing the final exam is necessary condition for passing the course*

Equity Services Accommodation:
http://www.carleton.ca/equity/accommodation/outlines.htm