# ELEC5508 / ELG6358

# COMPUTER METHODS FOR ANALYSIS AND DESIGN OF VLSI CIRCUITS

This course is intended for developers/users of CAD tools and circuit/system designers. The first part of the course covers the basic principles of circuit simulation. The second part focuses on advanced analysis techniques. Application of these algorithms covers a wide spectrum of implementation channels including chips, printed circuit boards and packages.

## Course Content:

**Principles of Circuit Simulation (40%):** *formulation of circuit equation in the frequency and time-domains; Laplace and Fourier transforms, Sparse techniques, solution of algebraic equations, multi-step methods and coupled differential equations, poles and zero, internal and Lyapunov stability, Backward-differentiation ,truncation error, numerical stability, L-stable methods, Obreshkov formula, solution of nonlinear algebraic-differential equations, Jacobian matrix, direct and adjoint sensitivity analysis*

**Advanced Analysis Techniques (60%):** *Asymptotic Waveform Evaluation, Complex-Frequency Hopping, moments matching, orthogonal basis of subspace, QR decomposition, projection techniques, Krylov subspace techniques, model-order reduction, positive-real matrices, passivity, congruence transformation, Arnoldi algorithm, Prima algorithm, macromodelling, current research topics*

***Background Pre-requisite:*** *Strong background in Math, Circuit Theory, Numerical techniques and Linear Algebra*


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Course Webpage: http://www.doe.carleton.ca/courses/ELEC5508/

**Grading**

**55% Final Exam** ***(open Book)***
**45% Assignments**

## REFERENCES


**(1) Computer Methods for Circuit Analysis & Design**
*J. Vlach and K. Singhal, Van Nostrand Reinhold 1983/ 1994*

**(2) Electronic Circuit and Simulation Methods**
*L. Pillage, R. Rohrer, C. Visweswariah, McGraw-Hill 1995*

**(3) Circuit Simulation**
*F. Najm, Wiley, 2010.*

**(4) Asymptotic Waveform Evaluation and Moment Matching for Interconnect Analysis**
*Eli Chiprout and Michel Nakhla, Kluwer Academic Publisher 1994*

**(5) IC Interconnect Analysis:**
*M. Celik, L. Pileggi and A. Odabasioglu, Kluwer Academic Publisher 2004*

**(6) Simulation of High-Speed Interconnects**:
*R. Achar & M. Nakhla, Proceedings of the IEEE, May 2001*


## + Handouts

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