**ECE 552
Numerical Circuit Analysis

Fall 2017
Instructor: Ibrahim Hajj**

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| **Web Page** | <http://courses.engr.illinois.edu/ece552/> |
| **Official Description** | Formulation of circuit equations; sparse matrix algorithms for the solution of large systems, AC, DC, and transient analysis of electrical circuits; sensitivity analysis; decomposition methods; reduced-order modeling. Same as CSE 532. Prerequisite: MATH 415 and ECE 210. |
| **Topics** | * Network topology: circuit equation formulation; nodal analysis; modified nodal analysis
* Solution of linear circuit equations: LU factorization; relaxation methods
* Sparse matrix techniques for circuit equation solution: decomposition techniques
* DC solution of nonlinear circuits: fixed-point; Newton's methods; modified Newton's method; relaxation methods; Gauss-Seidel method, piecewise-linear solution techniques
* Transient analysis: numerical integration; linear multistep methods; stability; accuracy, step control, companion models; time-domain decomposition methods; relaxation methods; analysis sequencing; latency; timing analysis
* Sensitivity analysis: small-change and large-change sensitivities
* Reduced-order modeling
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| **Text****Grading:**Midterm 20%Final exam 40%Project 30%HWs 10% | I. N. Hajj, *Computational Methods in Circuit Simulation.* Amazon 2016.References:1. J. Vlach and K. Singhal, *Computer Methods for Circuit Analysis & Design*, Van Nostrand Reinhold Co., 2nd ed., 1994.2. L. T. Pillage, R. A. Rohrer and C. Visweswariah, *Electronic and System Simulation Methods,* McGraw-Hill, Inc., 1995.3. Farid Najm, *Circuit Simulation,* IEEE/John Wiley, 20104. J.D. Lambert, *Numerical methods for Ordinary Differential Equations*, John Wiley, 1991.5. G. H. Golub and C. F. Van Loan, *Matrix Computations*, The John Hopkins University Press, 3rd Edition, 1996.6. Y. Saad, *Iterative Methods for Sparse Linear Systems*, 2nd Edition, Siam 2003. |