

Advanced Numerical Methods, MIE 603

Course Information

Lecture: Tues/Thur 2:30-3:45, Marston 15

Instructor: Prof. Blair Perot

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Office Hours: By appointment.

Text: (optional)

APPLIED NUMERICAL METHODS FOR ENGINEERS, 5th Edition,
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Web Page:

<http://www.ecs.umass.edu/mie/faculty/perot/mie603>

Grading:

- Homework: 35%
- Participation: 5%
- Midterm: 25%
- Final Exam: 35%

Academic Honesty Policy:

www.umass.edu/dean_students/codeofconduct/acadhonesty

Syllabus

Date	Reading	Assignment	Content
Sep 8 (tu)	no class	On travel	
Sep 10 (th)	no class	On travel	
Sep 15 (tu)	Chap 1-3		Introduction / Precision
Sep 17 (th)	Chapter 5		Bisection
Sep 22 (tu)	Chapter 6		Newton-Raphson
Sep 24 (th)			
Sep 29 (tu)	Chapter 9		Matrix Inversion
Oct 1 (th)	Chapter 10	HW1 due	Gauss Elimination
Oct 6 (tu)			LU, Inverse
Oct 8 (th)	Chapter 11		Jacobi/GS
Oct 13 (tu)		class	SOR
Oct 15 (th)	Handout		CG
Oct 20 (tu)		HW2 due	Krylov Methods
Oct 22 (th)			
Oct 27 (tu)			Review
Oct 28 (we)	at night	Midterm Exam	
Oct 29 (th)	Chapter 21		Integration rules
Nov 3 (tu)	Chapter 22		Gauss Quadrature
Nov 5 (th)	Chapter 23		Advanced Quadrature
Nov 10 (tu)			Model problem for ODE's
Nov 12 (th)	Chapter 25		Runge-Kutta
Nov 17 (tu)	Chapter 26	HW3 due	Multistep
Nov 19 (th)			Implicit methods
Nov 24 (tu)			Accuracy, Modified wavenumber
Nov 26 (th)	no class	Thanksgiving	Symplectic Methods
Dec 1 (tu)			Error Analysis/ Stability
Dec 3 (th)	Chapter 29/30		
Dec 8 (tu)	Chapter 31	HW4 due	FE/FV
Dec 10 (th)			Review
TBA		Final Exam	

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Course Topics

1. Preliminaries

Programming
Precision / Round-off errors.

2. Nonlinear Solution Methods

Bisection
Newton-Raphson
Secant Method

3. Linear Algebra (Matrix Inversion)

Gauss Elimination
Jacobi, Gauss-Seidel, SOR
Conjugate Gradients (Krylov subspace methods)
Multigrid

4. Simple Calculus

Trapezoidal Rule, Simpson's rule
Error analysis
Gauss quadrature
Richardson extrapolation, Adaptive quadrature
Finite Difference, Pade approximation
Accuracy, Modified wavenumber analysis, Spectral methods

5. Differential Equations (Ordinary)

Model Problem,
Runge-Kutta methods (Predictor-Corrector)
Multistep methods
Implicit methods
Accuracy, Stability
Systems of ODE's
Diffusion, Convection, phase & amplitude errors.
Stiffness, eigenvalues