
**Lectures:** MW: 3:55 - 5:15 PM, 207 SC

**Instructor:**
Mark Pekkér 201N SC, ph. 824-6470 (Dept.)
824-6879 (of.), E-mail: mark.pekker@uah.edu

**Office hours:**
MW: 2:30-3:50, 5:15-5:25 PM, TuTh:2:00-2:20, 3:40-4:50 PM
or by appointment

**Text:**
Uri Ascher and Chen Greif, A First Course in Numerical Methods, SIAM, 2011
Todd Young and Martin J.Mohlenkamp, Introduction to Numerical Methods and Matlab Programming for Engineers (supplement), 2014

**Final:**
December 7, Wednesday, 3:00 - 5:30 PM

**Policy:** Regular homeworks assigned (may or may not be collected), including programming assignments in MATLAB, and quizzes (from homework problems and examples from lectures), announced in advance. You may discuss computer programs with your classmates, but the work must be yours. *No late homework will be accepted!* Grade composition: homework assignments and quizzes 40%, Mid-term exam: 25%, Final exam (comprehensive): 35%. *Make-ups:* If you miss a test due to a documented illness, family emergency or other extreme circumstance, the weight of your remaining grades will be adjusted to compensate, provided I receive a *written* excuse within a reasonable amount of time after the missed test.

**MATLAB.** All programming assignments are in MATLAB. MATLAB is a computing environment with programming capability, good graphics, and powerful library functions. It is available on campus in several computer labs. Alternatively, a Student version of MATLAB can be purchased in the campus bookstore.

**Prerequisites.** MA 201 and MA 244, CS 121, and one MA course at the 300 level. Lab fee: $40.

**Course Goals.** After completing this course, you should:

- be familiar with modern techniques in scientific computing
- know about and understand the basic concepts and numerical techniques that have a high level of applicability to engineering, computer science, and industrial mathematics
- know current methods, issues, and software and have an adequate theoretical foundation to understand their efficiency and their computational limitations
- understand how to properly apply modern techniques in scientific computing
- have a strong enough background to be able to practically apply modern techniques in scientific computing

Homework assignments, M-files for the course, and links to online MATLAB tutorials will be available from Canvas and from http://uah.edu/faculty/pekker (click MA415).
Tentative course outline.

1. Numerical algorithms (Chapter 1)
   (a) Scientific computing
   (b) Roundoff, discretization and convergence errors
   (c) Algorithm properties

2. Roundoff errors (Chapter 2)
   (a) Floating point word and rounding unit
   (b) Roundoff error propagation, rough appearance

3. Nonlinear Equations in One Variable (Chapter 3)
   (a) Solving nonlinear equations
   (b) Bisection method
   (c) Fixed point iteration
   (d) Newton’s method and variants

4. Linear Algebra Background (Chapter 4)
   (a) Review of basic concepts
   (b) Vector and matrix norms

5. Linear Systems: Direct Methods (Chapter 5)
   (a) Gaussian elimination and backward substitution
   (b) LU decomposition
   (c) Pivoting strategies

6. Polynomial interpolation (Chapter 10)
   (a) General approximation and interpolation
   (b) Monomial and Lagrange forms
   (c) Newton’s form and divided differences
   (d) Chebyshev interpolation
   (e) Interpolating also derivative values

7. Piecewise polynomial interpolation (Chapter 11)
   (a) Broken line and piecewise cubic Hermite
(b) Cubic spline

8. Numerical differentiation and integration (Chapters 14, 15)

(a) Deriving differentiation formulas
(b) Roundoff and data errors in numerical differentiation
(c) Basic quadrature
(d) Adaptive quadrature
(e) Richardson extrapolation and Romberg integration

Withdrawal Policy. The student is responsible to determine the dates for withdrawing from the course. The student should be familiar with those policies and dates set by the university. Class non-attendance does not constitute withdrawal nor does notification to the instructor. Any student failing to follow the established procedure for withdrawal will continue to be enrolled in the class and may receive a failing grade in that course.

Academic Misconduct. Institutional policies will be followed regarding cheating or any other forms of academic misconduct in the class. These policies are stated in the student handbook. In any instance of misconduct, the student in question will be granted Due Process by the instructor in all proceedings.

College of Science Complaint Procedures: If you have difficulties or complaints related to this course, your first action usually should be to discuss them with me. If such a discussion would be uncomfortable for you or fails to resolve your difficulties, you should contact Professor Jia Li, Chair of the Department of Mathematical Sciences. Professor Li’s office is SC 258A. His telephone number is 256-824-6470. If you still are unsatisfied, you should discuss the matter with Emanuel Waddell, Associate Dean of the College of Science. The Associate Dean’s office is MSB C207, telephone number is 256 824 6844 and email address is adeancos@uah.edu.

Students with Disabilities: Your instructor would like to hear from anyone who has a disability that may require a modification of seating, testing, or other class procedures. Please see me after class or during office hours to discuss appropriate modifications. You should also contact Disability Support Services in Madison 131 (Ph. 824 1997) for further assistance.

UAAlert Emergency Notification System:

UAHuntsville has implemented the UAAlert emergency notification system. UAAlert allows you to receive time-sensitive emergency messages in the form of e-mail, voice mail, and text messages. Everyone who has a UAHuntsville e-mail address will receive emergency alerts to their campus e-mail address. In order to also receive text and voice message alerts, you are asked to provide up-to-date phone contact information. Participation in UAAlert text and voice messaging is optional, but enrollment is strongly encouraged. You can’t be reached through UAAlert unless you participate. The information you supply is considered confidential and will not be shared or used for purposes other than emergency notification.

To review your UAAlert account, add or update phone and alternate e-mail addresses, and set the priority for your contact methods, please visit the UAAlert web site: http://ualert.uah.edu.