MATH 5300 - 001. Introduction to Scientific Computing  
Spring, 2015  
TuTh 3:30PM - 4:50PM  
Pickard Hall, Room 109

INSTRUCTOR:  
Dr. Hristo V. Kojouharov (hristo@uta.edu, 817-272-5763, 441 PKH)

FACULTY PROFILE:  
https://www.uta.edu/profiles/hristo-kojouharov

OFFICE HOURS:  
Tu Th 2:00PM - 3:00PM or by appointment

REQUIRED TEXTBOOK:  

OTHER REQUIREMENTS:  
Students will need access to a computer with the program MATLAB installed.  
UT Arlington computing facilities with MATLAB access:  
- University Center Computer Lab, 2nd floor  
- Engineering Lab Building, Room 256  
Students will need access to a computer with an internet connection and web browser to obtain various course materials.

DESCRIPTION OF COURSE CONTENT:
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All fields of science and engineering rely heavily on numerical computing. The traditional two branches of science are theoretical science and experimental science. Computational science is now often mentioned as a third branch, having a status that is essentially equal to, perhaps even eclipsing, that of its two older siblings. The availability of greatly improved computational
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techniques and immensely faster computers allows the routine solution of complicated problems that would have seemed impossible just a generation ago."

-- Michael L. Overton, Courant Institute of Mathematical Sciences

This course provides a deeper look into the computational aspects of many numerical techniques used for solving otherwise intractable problems in science and engineering. It also serves as an introduction to scientific programming in the numerical MATrix LABoratory language MATLAB. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

STUDENT LEARNING OUTCOMES:

Students will be able to use the numerical MATrix LABoratory language (MATLAB) for scientific programming applications. Students will be able to demonstrate knowledge of how numbers are represented in a computer system and discuss presence of computer errors in representing numbers. Students will become familiar with a variety of numerical methods for solving mathematical problems that involve systems of linear equations; nonlinear equations/systems; definite integrals; first- and higher-order derivatives; and polynomial interpolation. Students will be able to apply numerical methods to solve real-world problems that involve models of the five mathematical types listed above; to discuss the advantages and disadvantages of the implemented methods; and to write and present a short report (term paper) in front of an audience of peers/classmates.

SCHEDULE OF LECTURE TOPICS:

Topics covered during the semester in MATH 5300 include:
- Number Representations and Errors: Chapter 1
- Getting Started with MATLAB (class meets in the PC Lab, PKH#313)
- Direct and Iterative Methods for Solving Linear Systems: Chapters 2 & 8
- Numerical Methods for Solving Equations of One Variable: Chapter 3
- Interpolation and Polynomial Approximation: Chapter 4
- Numerical Methods for Differentiation and Integration: Chapters 4 & 5
- Numerical Methods for Differential Equations: Chapter 7
"As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. -Hristo V. Kojouharov."

**GRADING POLICY:**

Grades are based on weekly homework assignments, two midterm exams, and a term paper. There is no extra credit.

- **Homework Assignments** (10%): Theoretical and computational problems will be assigned regularly throughout the semester. Homework assignments will usually be assigned weekly on Thursdays, and written reports will be due the following Thursday. Teamwork is encouraged.

- **Two Mid-Term Exams** (70%): Each mid-term exam will be given during a class period and you will have 80 minutes to take it. Exams will be made up of questions similar to the assigned homework problems. A tentative schedule of the exams is as follows: Exam #1 - Thursday, March 26, 2015; Exam #2 - Thursday, April 30, 2015. Topics and exact dates for each exam will be announced in class at least a week in advance. Make-ups for exams will be given only for the university approved absences, and should be discussed prior to the exam.

- **Term Paper** (20%): A short report discussing the numerical solutions, interpretation, and comparison of the results of a project must be submitted at least one week before the last day of classes. The project should be about a real-world problem and you should implement two different numerical algorithms, in a computer language of choice or use any available software, to solve it. I highly encourage the use of MATLAB for this project. A hard-copy of the term papers must be submitted by Thursday, April 30, 2015. In addition to a hardcopy submission, the term papers should be orally presented in class during the last week of classes.

**Grading Scale:**  

- **A** = 90+; **B** = 80-89; **C** = 70-79; **D** = 60-69;  
- **F** = 59-

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

**ATTENDANCE AND OTHER REQUIREMENTS:**

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Class participation is an important aspect of this course, so be considerate of other students and arrive on time. Please turn off cell phones, tablets, and other electronic devices.

USEFUL LINKS:

- **Sample Computer Codes** and other material related to the book "Numerical Mathematics and Computing" by W. Cheney and D. Kincaid.

- **ISI Web of Knowledge**
- **MathSciNet (American Mathematical Society)**
- **UTA Libraries (Online Catalog)**
- **UTA Interlibrary Loan Online**
- **Numerical Methods Resources (REU: CSU-Fullerton)** as compiled by John H. Mathews.

- **MATLAB® - The Language of Technical Computing**: online help from The MathWorks web site (look in particular in the "Documentation" menu)
- **MathTools**: technical computing scientific and engineering portal

- **Collection of Software Bugs**, as compiled by Thomas Huckle.
- **Disasters attributable to rounding and other errors in numerical computations**, as compiled by Douglas Arnold.

- **Term Paper Guidelines** (excerpts from "How to Write Up Computer Problem Homework" by David A. Kopriva)

IMPORTANT UNIVERSITY POLICIES

- **Drop Policy**: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student’s responsibility to officially withdraw if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing.
For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aoa/fao/).

- **Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the **Americans with Disabilities Act (ADA).** All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at http://www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

- **Title IX:** The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit www.uta.edu/titleIX.

- **Academic Integrity:** All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

  I *pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

  I *promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, 2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

- **Student Support Services Available:** The University of Texas at Arlington provides a variety of resources and programs designed to
help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. These resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals to resources for any reason, students may contact the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at http://www.uta.edu/resources

- **Electronic Communication Policy:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at: http://www.uta.edu/oit/cs/email/mavmail.php

- **Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as "lecture", "seminar", or "laboratory" shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

- **Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.
• **Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located outside of the classroom. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

• **After Hours Safety Escort:** The Sam Mav Escort service provides a service to assist students, faculty, staff and campus visitors to reach their destinations after regular business hours. The hours of service are 7:00 p.m. to 1:00 a.m., Sunday through Saturday. 817-272-3381.