MATH 5345
NUMERICAL OPTIMIZATION
The University of Texas at El Paso

Instructor: Dr. Miguel Argaez, margaez@utep.edu
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Term: Spring Semester 2019
CRN 23710

Credit Hours: 3

Meetings & location: TR 6:30 pm– 7:50 pm Undergraduate Learning Center. 338

Office Hours: TR 2:00 pm -3:00 pm or by appointment

Prerequisites: Linear Algebra or Numerical analysis, basic knowledge of Matlab programming.


Motivation and Description:
Everyday grows the need to formulate applications that arise in science, engineering, and business as either an unconstrained or a constrained optimization problem. This class covers the fundamental theories in continuous optimization and MATLAB implementation software. In unconstrained optimization, we study the solution of square nonlinear equations and minimization of an objective function. Also, we study the solution of linear and nonlinear least-squares problems. In constrained optimization, we study the solution of quadratic programming problems, and then these ideas are extended to solve the general nonlinear constrained optimization using primal-dual interior-point and logarithmic barriers methods.

Course Schedule:
1. Newton methods for unconstrained problems
   1.1 Solving square nonlinear equations
   1.2 Unconstrained minimization
   1.3 Globalization Strategies: line search and trust regions
2. Least-Squares Problems (LSP)
   2.1 Linear least-squares problems
   2.2 Tikhonov regularization
   2.3 Newton method for nonlinear least squares problems
   2.4 Gauss-Newton for nonlinear least-squares problems
   2.5 Levenberg-Marquardt for nonlinear least square problems

3. Model Order Reduction
   3.1 Formulation of the problem
   3.2 Petrov-Galerkin projection
   3.3 Gauss-Newton method for a composite function model reduction.

4. Constrained Optimization
   4.1 Quadratic programming
   4.2 Equality constrained optimization
   4.3 General nonlinear optimization: Interior-Point and logarithmic barrier methods

**Grading Policy:**
Two Midterm 30% (each), Final Exam 30%, Attendance 10%
Spring break March 18-22, 2019. Course drop **deadline April 5, 2019 with W**.
Final Exam: May 16, 2019 Thursday. 7:00 p.m. 9:45 p.m.

**Make-up Policy:**
No make-up/alternate exam will be given.
If you have an emergency on the exam day, you have to contact me immediately.

**Attendance Policy:**
It is student’s responsibility to attend every class. Students are expected to arrive for class on time and to remain for the class entire period.

**Academic Integrity Policy:**
The University policy is that all suspected cases or acts of alleged scholastic dishonesty must be referred to the Dean of Students for investigation and appropriate disposition. Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to cheating, plagiarism, collusion, and the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. For further information, please refer to:
http://www.lib.iastate.edu/commons/resources/facultyguides/plagiarism/dishonest.html

**Civility Statement:**
Please do not use cell phones, pagers, iPods, MP3 players, blue tooth devices, etc. during class. Cell phones and pagers should be set to silent or vibrate, and any calls should be taken outside of class. Please do not wear headsets or blue tooth devices during class.

**Disability Statement:**
If a student has or suspects she/he has a disability and needs an accommodation, he/she should contact the Disabled Student Services Office (DSSO) at 747-5148 or at <dss@utep.edu> or go to Room 106 Union East Building. The student is responsible for presenting to the instructor any DSS accommodation letters and instructions.
Military Statement: If you are a military student with the potential of being called to military service and/or training during the semester, please contact me by the end of the first week of class.