USCSchool Name

AME 599: Special Topics – Multidisciplinary Design Analysis and Optimization for Engineers
Units: 3
Spring 2017— TBD

Location: TBD

Instructor: Prof. David McCormick
Office: TBD
Office Hours: TBD

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Teaching Assistant: TBD
Office: TBD
Office Hours: TBD
Contact Info: TBD

IT Help: Group to contact for technological services, if applicable.
Hours of Service:
Contact Info: Email, phone number (office, cell), Skype, etc

Course Description

Multidisciplinary Design Analysis and Optimization (MDAO) is the study of exploiting mutually interacting phenomena to the benefit of engineering designs. By building and integrating models of system behaviors, MDAO techniques can be applied to find non-intuitive design solutions for those systems. This course intends to give students an introduction to and familiarity with some of the more popular methods while giving examples of how they can be applied to real-world engineering problems.

Learning Objectives

Students will learn how MDAO methods work, their limitations and will be expected to apply selected methods to example problems implemented in Matlab or Python.

Prerequisite(s): course(s) that must be taken prior to this course - NONE

Co-Requisite (s): course(s) that must be taken prior to or simultaneously - NONE

Concurrent Enrollment: course(s) that must be taken simultaneously - NONE

Recommended Preparation: course work or background that is advisable, not mandatory - NONE

Course Notes

Course notes will be made available after each class online.

Technological Proficiency and Hardware/Software Required

Class will be provided in a traditional setting.

Required Readings and Supplementary Materials

Multidiscipline Design Optimization, Vanderplaats, G.
https://www.vrand.com/BookOnOptimization.html
ISBN: 0-944956-04-1

Description and Assessment of Assignments

The course will consist of homework assignments and projects. It will be possible to complete homeworks without the aid of a computer, however, it is not required and a computer may be used. Projects will be programming assignments requiring a computer. Matlab or Python are recommended, but Java, C, C++ and Fortran are also acceptable.

Grading Breakdown

There will be four homework assignments assigned, three projects and a final exam. The grading and points breakdown is as follows:

Assignment	Points	% of Grade
HW1	15	12%
HW2	10	8%
HW3	10	8%
HW4	10	8%
Project1	20	16%
Project2	20	16%
Project3	20	16%
Final Exam	20	16%
TOTAL	125	100%

Assignment Submission Policy

Assignments will be given at the ends of class on the indicated dates and will be due before the beginning of class on the indicated dates.

Additional Policies

Late assignments will be accepted, but with a significant score penalty applied.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1 TBD	Introduction and Problem Formulation	Vanderplaats Ch. 1	
Week 2 TBD	Optimization Basics	Vanderplaats Ch. 1 HW1 from Vanderplaats Ch. 1	
Week 3 TBD	Gradient-based Optimization Concepts	Vanderplaats Ch. 2,3 Project 1 – Line Search	HW1 due
Week 4 TBD	Gradient-based Optimization Methods	Vanderplaats Ch. 5	
Week 5 TBD	Stochastic / Discrete Optimization Methods	Vanderplaats Ch. 8 Project 2—Simulated Annealing	Project 1 due
Week 6 TBD	Composite Objective Formulations	Vanderplaats Ch. 8	
Week 7 TBD	Multi-Objective Optimization Techniques	Vanderplaats Ch. 8 HW2 from Vanderplaats Ch. 8	Project 2 due
Week 8 TBD	Sensitivity Analysis and Variable Reduction	Project 3 – Design of Experiments	HW2 due
Week 9 TBD	Robust Design		
Week 10 TBD	NO CLASS–SPRING BREAK		
Week 11 TBD	Fast Probability Integration Methods		
Week 12 TBD	Function-based Meta-Models	Vanderplaats Ch. 7 HW3 from Ch.7	Project 3 due
Week 13 TBD	Other Meta-Models	Vanderplaats Ch. 7 HW4 from Ch.7	HW3 due
Week 14 TBD	Reduced Cost Gradients		HW4 due
Week 15 TBD	Multi-level Optimization Techniques	Vanderplaats Ch. 11	
Week 16 TBD	Example Design Process		
FINAL Date - TBD			Date: For the date and time of the final for this class, consult the USC Schedule of Classes at www.usc.edu/soc.

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://adminopsnet.usc.edu/department/department-public-safety. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* *http://emergency.usc.edu* will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.