Mathematical Modeling (STAT 420/620) Spring 2015
Davidson Mathematics and Science (DMS), Room 106
TR 11:00AM-12:15PM
3 credits

Instructor: Ilya Zaliapin **Office:** Davidson Math & Science (DMS), Room 221

Office hours: TR 9:50–10:50AM + TR 4:00-5:00PM + by appointment

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Course web page: http://www.unr.edu/~zal/MATH620_Spring2015.html

Intro: "Mathematical modeling is the link between mathematics and the rest of the world. Some people are fluent in English, and some are fluent in calculus. We need more people who are fluent in both languages and are willing and able to translate. These are the people who will be influential in solving the problems of future." (Mark Meerschaert, *Mathematical Modeling*, 2013). The class participants build proficiency in the essential methods of mathematical modeling roughly classified into three groups: optimization, dynamic models, and probability models. A serious attention is paid to the computational aspects and numerical implementation of the discussed methods. Selected applications in physics, biology, economics, and other fields are discussed.

Required textbook:
> Mark Meerschaert (2013) *Mathematical Modeling,* 4th ed., Academic Press.

Tentative list of topics:
- Optimization Models: One-variable/multivariable optimization, Constrained Optimization, Computational Methods
- Dynamic Models: Phase portrait, Spectral analysis, Euler method, Chaos and Fractals
- Probability Models: Random walks and diffusion, Markov chains, Time series models, Monte Carlo methods

Course Objectives:
- Core Objective 13 (Integration & Synthesis): Students will be able to integrate and synthesize Core knowledge, enabling them to analyze open-ended problems or complex issues.
- Core Objective 14 (Application): Students will be able to demonstrate their knowledge and skills developed in previous Core and major classes by completing a project or structured experience of practical significance.

Student Learning Outcomes:
Upon completion of this course, students will be able to

- Choose and apply key mathematical and statistical techniques for solving problems in a diverse collection of scientific disciplines (CO 2, CO 13)

- Organize and clean data; critically assess the origin of the data and method of data analysis (CO 3, CO 13).

- Interpret the results of the modeling process to reach sound scientific conclusions within the problem's economic, scientific, and social context (CO 9).

- Propose a project (individually or in a group) and devise strategies and practices to do the research work that will lead, with the support of computational software (e.g., Maple, Mathematica, R, Matlab), to the writing of a technical report using professional typesetting software (e.g., LaTeX) (CO 14).

Technology: MAPLE software (http://www.maplesoft.com/) is used for class discussions and homework problems. The program can be accessed through the library's Citrix server at https://citrix.unr.edu/

Midterm: There will be one midterm. The date will be announced in advance.

Final exam: Final exam will be given on Thursday, May 7, 8:00-10:00AM.

Exam policy (for midterm and final): Open notes, open books. There will be **no make-ups** for exams, except legitimate medical reasons. In case of participating in University-related activities or in any other special circumstances, contact instructor **in advance**.

Home works are given weekly and require a printed report. The homework report consists of problem solution (including method description and a software code) and interpretation/discussion. Both parts are graded. You are encouraged to discuss HW assignments with each other and with instructor during office hours. However, the homework reports must be written individually.

Grading policy: A letter grade for the course is based on home works (40%), midterm (30%), and final exam (30%).

Letter	A	A-	B+	B	B-	C+	C	D+	D
Min. Score	93%	90%	87%	83%	80%	77%	70%	67%	60%

Prerequisites: MATH 283R with a "C-" or better; MATH/STAT 352 or MATH 461.

Graduate/Undergraduate levels: Graduate students will achieve deeper understanding of the material and will be offered sufficient opportunities for work at a higher academic level. This will be done by choosing different quality and quantity of assignments for homeworks and exams.

Academic dishonesty will not be tolerated and will result in an F grade. See http://www.unr.edu/stsv/acdispol.html for more information.

Class recording policy: Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

Special needs: The Department of Mathematics and Statistics supports providing equal access for students with disabilities. Any student needing accommodations for a specific disability is encouraged to meet with instructor or any Department representative at your earliest convenience to ensure timely and appropriate accommodations.

Academic Success Services: Your student fees cover usage of the Math Center (775) 784-4422, Tutoring Center (775) 784-6801, and University Writing Center (775) 784-6030. These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.