



SE4420 Modeling and Simulation in Acquisition

Course Syllabus

Winter 2026

Course Description

This course surveys the modeling and simulation (M&S) tools, techniques, and procedures used to support Department of Defense (DOD) acquisition. Multiple M&S approaches and tools are presented with emphasis on the differences in application between model types. Upon completion, students will be able to identify a particular tool and apply it appropriately to support system acquisition and relate specific tools to the decision points that separate the acquisition phases. Students will be able to identify development, application, and analysis considerations related to M&S for a representative system.

Goals & Outcomes

This course builds on the fundamentals of systems engineering by providing the tools necessary to create, analyze and compare system models and simulations. Modeling and simulation are used to analyze the operational effectiveness and performance of existing systems, emerging technological concepts, and planned systems to support acquisition decisions. This course covers the language, terminology, concepts, methods, and tools of M&S through review and development of multiple types of system models. The student practices these skills through lab exercises and assignments. Upon completion the student will be able to:

- Describe practical considerations and fundamentals of M&S, to include distinctions between different types of models and the role of humans in M&S development.
- Understand and construct appropriate operational system models and simulations to support the acquisition lifecycle. Focus will be given to the differences between discrete event, agent based, and systems dynamics continuous simulations.
- Conduct M&S assessments appropriate to support system acquisition. Use statistical analysis methods for acquisition tradespace analysis, comparison of alternatives, and to justify acquisition recommendations.
- Communicate effectively both verbally and in writing.

Prerequisites

SE3100 Fundamentals of Systems Engineering, OS3180 Probability and Statistics for Systems Engineering

Instructor

Dr. Raymond Madachy, Professor
Department of Systems Engineering
Email: rjmadach@nps.edu
Hours: Available by appointment

Class Meetings

Online via Zoom on Thursdays at 08:00 – 11:00 PT.

<https://nps-edu.zoomgov.com/j/1609829255>

Meeting ID: 160 982 9255

Passcode: @SE4420w26

Textbook

R. Madachy and D. Houston, *What Every Engineer Should Know about Modeling and Simulation*, CRC Press, 2018.

Topics and Schedule

Below is a tentative schedule and grading that may be revised at the discretion of the Professor during the quarter.

Week	Topics	Readings
1	Course Overview, M & S Introduction	Course Syllabus, Ch. 1, Appendix A
2	Continuous Systems Modeling	Ch. 3.1
3	M & S Method	Ch. 2
4	Discrete Event Modeling	Ch. 3.2
5	Agent-based Modeling	Ch. 3.3
6	Randomness and Monte Carlo Analysis	Ch. 4.1 – 4.2, Ch. 4.4
7	Input Analysis and Estimating Parameters	Ch. 5.1 – 5.4
8	Model Execution and Output Analysis	Ch. 6.1 – 6.5
9	Special Topics	TBD
10	Final Team Presentations	

Grading

Homework 50%

Group Project 35%

Quizzes 15%

NPS Honor Code

NAVAL POSTGRADUATE SCHOOL HONOR CODE (ref: NAVPGSCOLINST 5370.1D)

Academic integrity at the Naval Postgraduate School is based on a respect for individual achievement that lies at the heart of academic culture. Every faculty member and student belongs to a community of scholars where academic integrity is a fundamental commitment. Academic dishonesty is not tolerated.

Unless otherwise stated by the instructor: all in-class work submitted for a grade will be the student's own, performed without reference to materials or other individuals.

Graded work assigned for completion outside the classroom allows the use of reference material, but shall be performed without the assistance of other individuals. **To be more specific, takehome**

tests or exams for resident students or assignments and exams for distance learning courses shall be students' own original work. There shall be absolutely no assistance from any other person by any means including, but not limited to: conversation; copying written work; phone conversations; or any electronic communication. All books, notes, and on-line sources that do not involve interaction with a person may be used. *All written work should appropriately identify referenced material.* This default policy for take home tests or exams is in force unless other specific instructions are provided by the faculty member in charge of the course.

While no single list can hope to identify and define all types of academic honor code standards, the following are cited as examples of unacceptable behavior:

Cheating. Using unauthorized notes, study aids, or information on an examination; looking at another student's paper during an examination; altering a graded work after it has been returned, then resubmitting it for regrading; allowing another person to do one's work and submitting it under one's own name.

Plagiarism. Submitting material that in part or whole is not entirely one's own work without attributing those same portions to their correct source.

Fabrication. Falsifying or inventing any information, data, or citation.

Obtaining an Unfair Advantage. Gaining access to examination materials prior to the time authorized by the instructor, unauthorized collaboration on an academic assignment; possessing, using, or circulating previously given examination materials where those materials clearly indicate that they are to be returned to the instructor at the conclusion of the examination.

Aiding and Abetting Academic Dishonesty. Providing material, information or other assistance to another with knowledge that such aid could be used in any of the unacceptable behaviors described above; failure to address observed violations of this code.

Falsification of Records and Official Documents. Altering documents affecting academic records.

Syllabus Version

Updated January 5, 2026