

Instructor: Mette S. Olufsen
Office: HA235
Phone: 515 2678
Email: msolufse@unity.ncsu.edu

Time: Tuesday, Thursday 10.15AM-11.30PM, HA266.

Texts: The course will mainly use course notes and journal articles, which will be distributed electronically. Books used occasionally (not required) include: “Modeling and Simulation in Medicine and the Life Sciences”. Frank C Hoppensteadt and Charles S. Peskin, second edition 2002, Springer Verlag. “Modeling Biological Systems, Principles and Applications”. James W Haefner, second edition 2005, Springer Verlag. This book was originally published by Chapman and Hall, 1996.

Format: The course will use a combination of lectures taken from the course notes and the book listed above. The course will require completion of homework and two group projects. The projects will be due in the middle and at the end of the semester. Project presentations and a report are required for each project. Final presentations will be made during the last week of classes and during the exam period.

Evaluation criteria: The course will be graded based on the work performed in the projects (the projects will account for 80% of the final grade). Each project requires a mid- and a final report as well as two presentations (a midway and a final presentation). For the final project each student will receive a question that has to be answered during the final presentation. The final presentation will run during the last week of classes and during the exam-period. In addition the students will receive homework problems that will account for 20% of the grade.

Projects: The work in your project has to be documented in a report. This report should contain the following information:

- A precise description of the questions that have to be answered by the model. What is the problem to be solved?
- A description in words of the system modeled. This description could be illustrated by diagrams that show the dynamics (flow) of the model. You have to write how your system is limited and what considerations you have made to reach the limited system.

- Data has to be presented and discussed. What is shown, how are they recorded, and how can they be used in the modeling process.
- Description of the mathematical representation of the system. That is the equations representing the model, including an explanation of what all symbols mean and what units they have.
- The model parameters have to be defined, and you have to consider what possibilities you have to estimate the value of the parameters, experimentally, and/or theoretically.
- If computer programs have been used during your modeling, they have to be documented and you have to explain how and why you have chosen your numerical algorithms. Your report should include a printout of your code.
- Mathematical analysis. What have you done to solve your problem analytically, and how are the equations reduced before they are treated numerically.
- Numerical analysis of the model. The constructed model can often be used to simulate a number of events. You can for example make a sensitivity analysis showing how changes in parameters and initial data affect the results, and if the project includes differential equations you should show that your results are stable, i.e. if your time step is halved then the results stay the same. The results from your numerical analysis have to be documented using graphs and/or tables. All figures have to be explained by clear figure legends.
- Analysis and discussion of the results seen in relation to the problem you had specified.
- Discussion of the models status, their usability, and their validity.