

# ME 678 Advanced Dynamics, fall 08

**Lectures:** TR 4:30p.m.-5:45p.m., Holmes Hall 211  
**Instructor:** Nikolaj Nordkvist  
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## Content

During the course we will attempt to cover the following topics:

- a) Configuration spaces for mechanical systems
- b) Calculus of variations
- c) Hamilton's principle, Lagrange's equations
- d) Conservation laws, Noether's theorem
- e) Hamilton's equations
- f) Canonical transformations
- g) Integrable and nearly integrable systems
- h) Numerical methods, symplectic integrators
- i) Mechanical systems with forces
- j) Nonholonomic systems
- k) Rigid bodies

## Textbooks

During the course we will mainly be using the lecture notes *Analytical Mechanics* which can be downloaded from <http://www2.hawaii.edu/~nikolaj/>. I suggest not to print all the pages at first as there might be additions and changes to the last part. Notice that the lecture notes are pretty dense and mathematical as they are truly meant as lecture notes and not as a source to learn the material from alone – the notes are intended to complement the lectures.

Standard references on the subject include *Classical Mechanics* by H. Goldstein and *Mathematical Methods of Classical Mechanics* by V. I. Arnold. Other good, and cheaper, books on the subject are *Classical Dynamics* by D. T. Greenwood and *Calculus of Variations* by I. M. Gelfand and S. V. Fomin. Any of these books would be of value as a supplementary text - I will bring them to the first lecture for the students to have a look at.

## Computer Usage

Some of the homework assignments require numerical software tools, like MATLAB (available in the computer labs) or SCILAB (similar to MATLAB, but can be downloaded for free). Prior experience with these tools would be beneficial but not required as we will only be writing simple programs using techniques covered in class.

For several of the homework assignments software that can handle symbolic calculations would greatly simplify matters. An example of such software is MAPLE which is very competent but expensive and not available in the computer labs. A free alternative is MAXIMA - WXMAXIMA provides a nice interface.

## Evaluation

The students will be assigned six (6) homework assignments and one (1) report during the semester. In the final grading the report will count 1/3 and the homework assignments 2/3.