SPECIAL GRADUATE COURSE:
COMBINED ODEs AND CLASSICAL MECHANICS
AMSC-MATH 670–671, MATH 6480

In this coming academic year I shall teach a two-semester course, meeting four hours (actually 200 minutes) per week, that combines ordinary differential equations and classical mechanics. The course will cover the entire syllabus of AMSC or MATH 670–671 together with the equivalent of a graduate course on classical mechanics. The prerequisites for the ODE part of the course are advanced calculus (MATH 411 or 412) and linear algebra (MATH 405). There are no prerequisites for the mechanics part of the course (beyond a belief that f=ma), which will be completely self-contained.

One objective of this course is to give students who have not been exposed to such traditional and fundamental applications of mathematics a simple way to fill in that gap. It is feasible to do so within the scope of two semesters because much of the traditional treatments of mechanics is devoted to mathematical questions (covered in the prerequisites or in the theory of ODEs) and much of the most illuminating examples of ODEs come from mechanics.

The course should be valuable also for those with substantial backgrounds in mechanics, not only by integrating mechanics with ODEs, but also by a careful attention to often ignored foundations. (E.g., the course will replace a traditional "definition" like "a virtual displacement is an infinitesimal displacement consistent with the constraints with time held fixed" with one that even a student of linear algebra can understand.) The course will cover the mechanics of Newton, Euler, Lagrange, and Hamilton, with special attention to rigid body mechanics, nonconservative problems, the treatment of constraints, the precise formulation and analysis of problems, the real uses of variational principles to handle periodic solutions and optimal control, and an introduction to modern geometrical methods.

The course is offered as AMSC and MATH 670–671 together with the one-credit course MATH 6480. Students can enroll for only the three-credit courses 670–671, in which case they could be responsible for only the ODE part of the course (together with the minimal amount of classical mechanics that is typically squeezed into that syllabus). But they would have to attend the full four hours per week because the topics would be integrated. (This option is designed to accommodate graduate assistants who have limits on the total number of credits they can take.)

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