Mathematical foundations of classical mechanics

Tuesday, Thursday 2:00 pm-3:15 pm

Description: we will start by recalling that Newton proposed three laws of motion as a foundation for his principles of natural philosophy, laying the foundations for classical mechanics. In particular he introduced calculus as a tool which allowed him to treat properly the laws of motion and gravitation. Methods developed later by Lagrange and Hamilton have found applications in many fields of mathematics and beyond, and we will talk about a number of such applications.

Topics: Basics of calculus of variations: (action) functional, variations of curves, extremals of a functional, the Euler-Lagrange equations; the second variation. Application of the calculus of variations to classical mechanics: the Principle of Least Action, the foundations of Lagrangian mechanics. Calculus of variations in optimal control, Pontryagin's Maximum Principle and its applications in control theory.

Prerequisites: Transition to Advanced Mathematics (2710 or 2710W), or Advanced Calculus II (2142), or instructor's permission.

Questions? Email the instructor, Masha Gordina, at `maria.gordina@uconn.edu`.

Textbook: Classical Mechanics with Calculus of Variations and Optimal Control: An Intuitive Introduction by Mark Levi