

Fall 2018 MATH 5010: Calculus of Variations

MW 2:30–3:45pm Classroom: MSCS 428

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Office-Hours: MW 4:00pm-5:00pm

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### Course Description

- Calculus of variations is a field of mathematical analysis that uses variations, which are small changes in functions and functionals, to find maxima and minima of functionals. As time allows, topics will include Euler-Lagrange conditions, Hamilton-Jacobi equations, Pontryagin maximum principle, bang-bang controls, and optimal feedback controls. The objective of this course will focus on the understanding of the topics listed and their applications to problems of mathematics, social science, physical science, and engineering. It is assumed that the student has some background in elementary differential equations and analysis.
- Prerequisites: MATH 4023 (Introduction to Analysis) or MATH 4143/5043 (Advanced Calculus I); Math 4233 (Intermediate differential equations)

### Textbook and References

- Lecture notes are based on
  - J. A. Burns. *An Introduction to the Calculus of Variations and Control with Modern Applications*. CRC Press, 2014.
- References:
  - G. M. Ewing. *Calculus of Variations with Applications*. Dover Publications, New York, 1985.
  - G. Leitmann. *The Calculus of Variations and Optimal Control*. Springer, Berlin, 1981.
  - I. Ekeland and R. Témam. *Convex Analysis and Variational Problems*. SIAM Classics in Applied Mathematics, 1999.
  - K. Ito and K. Kunisch. *Lagrange Multiplier Approach to Variational Problems and Applications*. SIAM Advances in Design and Control, 2008.

### Course Work

- Reading materials and final project will be assigned. Presentations will be required based on the reading materials and the final project.