MA563 Calculus of Variation 2009

Basic outline of the module

Lagrangians, Euler-Lagrange equations: unconstrained, constrained, various boundary conditions. First integrals, conservation laws and Noether's Theorem. Applications will be discussed throughout.
Time permitting, we will discuss discrete Lagrangians and Euler-Lagrange equations, links to Hamiltonian mechanics, the Legendre transform and symplectic integrators.

Timetable

This module is 2 hours a week throughout the teaching year. Lecture time in weeks 23 and 24 will be devoted to revision for the examination.

Assessment

Assessment will be 80% by a 2 hour closed book examination at the end of the year, 10% by a take-home, open book, problem based assignments, 5% by a take-home, Maple based assignment, and 5% either by a 3-page nano-project or a take-home assessment.
There will be exercise sheets which we will go through from time to time.

Recommended Reading List

There are quite a few books on Calculus of Variations, but many of them go far deeper than we will need. The following seem both useful and accessible.

L.Pars, "An introduction to the Calculus of Variations", Heinemann, 1962.

⋆ Bruce van Brunt, "The calculus of variations", Springer, 2004.

Charles Fox, "An Introduction to the Calculus of Variations", Dover reprint 1987.

Some handbooks on applied mathematics contain chapters on Calculus of Variations, a good one is by Courant and Hilbert, "Methods of Mathematical Physics", Volume 1 Chapter 4.

Contact Information

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- Students are strongly advised to make full use of office hours as and when questions or difficulties arise.
- This is a Calculus based module. You will need to be fluent with chain rule, quotient rule, integration by parts etc. You will also need to review how to solve the kinds of differential equations with initial and/or boundary conditions and recurrence relations that you met in first year Mathematical Methods.