ESI SENIOR RESEARCH FELLOW
LECTURE COURSE
Winter Term 2021/22

The Erwin Schrödinger International Institute for Mathematics and Physics (ESI) of the University of Vienna offers the following Lecture Course held by a Senior Research Fellow in residence during the Winter Term 2021/22:

Lower semicontinuity of integral functionals and applications
Martin Kružík (Czech Academy of Sciences, Prague)

Lecture Course (250136 VU): January 10 - 19, 2022
Time: 9:00 - 12:00
Start: Monday, January 10, 2022
Further dates: Wednesday, January 12, Friday, January 14, Monday, January 17, 2022, 9:00 - 11:00
End: Wednesday, January 19, 2022, 9:00 - 11:00

Venue: Erwin Schrödinger Institute, Schrödinger Lecture Hall

Abstract:
In 1830, B. Bolzano observed that continuous functions attain extreme values on compact intervals of reals. This idea was then significantly extended around 1900 by D. Hilbert who set up a framework, called the direct method, in which we can prove existence of minimizers/maximizers of nonlinear functionals. Semicontinuity plays a crucial role in these considerations. In 1965, N.G. Meyers significantly extended lower semicontinuity results for integral functionals depending on maps and their gradients available at that time. We recapitulate the development on this topic from that time on. Special attention will be paid to applications in continuum mechanics of solids. In particular, we review existing results applicable in nonlinear elasticity and emphasize the key importance of convexity and subdeterminants of matrix-valued gradients. Finally, we mention a couple of open problems and outline various generalizations of these results to more general first-order partial differential operators with applications to electromagnetism, for instance.

Content of the lecture course:
1. First-order problems
2. Higher-order problems and prolems with general differential constaints
3. Applications

Aims for the course:
The aim of the course is to introduced the students to the powerful world of variational methods and their applications to continuum mechanics of solids. Lower semicontinuity properties of energy functionals are an inevitable part of the theory. This also includes various notions of convexity and their relationship. Besides, the students will also learn various proof techniques together with their restrictions and limitations raising from applications to physics.

Course website: https://www.esi.ac.at/events/e395/

Christoph Dellago
Director