LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MATHEMATISCHES INSTITUT
PROF. THOMAS ØSTERGAARD SØRENSEN, PHD

VORLESUNGSANKÜNDIGUNG

WiSe16/17

Vorlesung (2 SWS ohne Übungen):

Hamilton-Jacobi Equations

Time and place: ***Tuesday 14:15-16:00 in B 040.***

First meeting: ***Tuesday October 18th 2016, 14:15 in B 040.***

Synopsis: In this course we will study classical and generalised (weak and viscosity) solutions to boundary and initial value problems for Hamilton-Jacobi Equations.

The Hamilton-Jacobi Equation (a nonlinear first order *P*artial *D*ifferential *E*quation (PDE)) arises in Classical Mechanics as equivalent to the Hamiltonian or Lagrangian formalism. It also arises in Optimisation in connection with control theory for *O*rdinary *D*ifferential *E*quations (ODEs) by the method of Dynamic Programming.

We will study classical solutions via the Method of Characteristics. For convex Hamiltonians depending only on the momentum p, we will study the existence and uniqueness of Lipschitz regular weak solutions via the Hopf-Lax formula. For more general Hamiltonians, we study the theory of viscosity solutions.

Topics to (possibly) be discussed: Hamilton's equations; (Method of) Characteristics; convex analysis; Legendre-Fenchel transformation (convex conjugate); Hopf-Lax formula; semi-concavity; viscosity solutions; Dynamic Programming (if time permits).

Audience: Master students of Mathematics (WP 17.2, 18.1, 18.2, 44.3, 45.2, 45.3) and Physics, TMP-Master.

Prerequisites: No previous knowledge of ODE, PDE, Classical Mechanics, or Convex Analysis is needed. However, some previous exposition to one or more of these topics, and a solid background in Analysis, is an advantage.

Language: The lecture will be in English.

Literature: Evans, *Partial Differential Equations, Second Edition*, AMS *(2010)* (and further literature).

Further information : http://www.math.lmu.de/~sorensen

Prof. Thomas Østergaard Sørensen, Ph.D.