LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MATHEMATISCHES INSTITUT
PROF. THOMAS ØSTERGAARD SØRENSEN, PHD

VORLESUNGSANKÜNDIGUNG

WiSe14/15

Vorlesung (2 SWS ohne Übungen):

Viscosity solutions of nonlinear PDEs

Time and place: ***Tuesday 16:15-17:45 in B ???.***

First meeting: ***Tuesday October 7th 2014, 16:15 in B ???.***

Synopsis: This course treats the viscosity solution theory for linear and nonlinear *P*artial *D*ifferential *E*quations (PDEs). Existence of solutions of PDEs is not easy to establish, the best strategy is to first show the existence of solutions in some generalised sense, and then establish regularity (to conclude existence of a *classical solution*). For equations in divergence form, this leads to the study of *weak solutions* (and Sobolev spaces) by testing (multiplying and integrating) against smooth functions (as studied in the course PDE 2 last semester).
For general nonlinear PDEs, and equations in non-divergence form, this approach does (often) not work. However, one can define a new type of generalised solutions (called *viscosity solutions*) by testing the solution in a whole new sense (inspired by the Maximum Principle for harmonic functions).

Topics to be discussed: Viscosity solutions, fully nonlinear elliptic PDEs, Hamilton-Jacobi (- Bellman-Isaacs) eq, Maximum Principles and Comparison Principles (for uniqueness), Perron's Method (for existence), stability (for continuity in the data), regularity (if time permits).

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

Prerequisites: Analysis I-III, Linear Algebra I-II.
Knowledge from PDE 1 (harmonic functions, Laplace and Poisson equations, elliptic equations) and PDE 2 (weak solutions, uniformly elliptic PDEs in divergence form) is an advantage, but **not needed**.

Language: The lecture will be in English.

Literature: S. Koike, *A Beginner's Guide to the Theory of Viscosity Solutions (2012).*

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

Prof. Thomas Østergaard Sørensen, Ph.D.