MATH 517 Partial Differential Equations II

January - April, 2020
http://www.math.ubc.ca/~ttsai/courses/517-20Q1/

Course Description

This is a continuation of MATH 516 (elementary linear PDEs), with the focus now on nonlinear PDEs. We will discuss variational, topological and other nonlinear methods for nonlinear differential equations, including the direct method of calculus of variations, mountain pass lemma, concentration compactness, method of moving planes, degree theory, Crandall-Rabinowitz bifurcation, monotonicity formula, and infinite dimensional Liapunov-Schmidt reduction method.

Lecture summaries and some references will be available in a public owncloud folder, whose link will be given to the audience. The link will expire on April 30, 2020.

Prerequisites

MATH 516 or equivalent. Other relevant materials will be reviewed during the course.

Topics

Here is the tentative outline. It can be adjusted according to audience background and interests.

- The direct methods in the calculus of variations, constrained minimizations
- Concentration compactness
- Minimax methods, mountain pass lemma
- Maximum principle and the method of moving planes
- Index theory
- Crandall-Rabinowitz bifurcation theorems and applications

References

- M. Struwe, Variational methods, applications to nonlinear partial differential equations and Hamiltonian systems, 4th ed.
  This is our main text for the first half of the course. (in owncloud)
- Chen, Wenxiong; Li, Congming, Methods on nonlinear elliptic equations.
  for the moving plane method. (in owncloud)

- Lawrence C. Evans, Partial differential equations, AMS, 1998.
- Gilbarg-Trudinger, Elliptic partial differential equations of second order, 2nd ed., Springer-Verlag, Classics in Mathematics series. (in owncloud)
- Qing Han and Fanghua Lin, Elliptic partial differential equations, volume 1 of Courant Lecture Notes in Mathematics.
- L. Nirenberg, Topics in nonlinear functional analysis, volume 6 of Courant Lecture Notes in Mathematics.
- Quittner-Souplet, Superlinear parabolic problems, blow-up, global existence and steady states. (in owncloud)

More references will be added during the term.

Evaluation

The evaluation is based on homework assignments and class participation.

Instructor and lectures

Instructor: Dr. Tai-Peng Tsai, Math building room 109, phone 604-822-2591, ttsai at math.ubc.ca.

Lectures: Tue Thu 14:00-15:15pm, Math Annex MATX 1118

Office hours: TBA, and by appointment (Tsai's schedule).
