Analysis and Operator Theory - Peter Takac

Tuesday, October 21, 2014 - 1:50pm to 2:45pm
Cockins Hall 240

Peter Takac

Title: Nonlinear spectral analysis and the Fredholm alternative for the p-Laplacian

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Seminar Type: Analysis and Operator Theory

Abstract: We briefly describe some basic mathematical challenges in the (nonlinear) spectral theory for the p-Laplace operator. It has been a long-standing open problem if *all* eigenvalues of the p-Laplace operator mapping the Sobolev space $W_0^{1,p}(\Omega)$ into its dual space $W^{-1,p'}(\Omega)$, $\frac{1}{p}+\frac{1}{p'}=1, 1<p<\infty$, are *variational* in some reasonable sense, e.g., given by the Ljusternik-Schnirelmann formula. For a closely related nonlinear operator, we will provide a counterexample, although for the genuine p-Laplacian this problem still remains open.

The first eigenvalue λ_1 and the corresponding eigenfunction φ_1 enjoy analogous properties as in the (classical) linear case $p=2$. We are concerned with the existence of a weak solution $u \in W_0^{1,p}(\Omega)$ to the degenerate quasilinear Dirichlet boundary value problem

$$-\Delta_p u = \lambda |u|^{p-2}u + f(x) \ \text{ in } \Omega; \qquad u = 0 \ \text{ on } \partial\Omega. \qquad \backslash\text{rm (P)}$$

It is assumed that 10 small enough). More precisely, we obtain at least *three* distinct solutions if either $p<2$ and $\lambda_1 - \delta < \lambda < \lambda_1$, or else $p>2$ and $\lambda_1 < \lambda < \lambda_1 + \delta$. Naturally, the (linear selfadjoint) Fredholm alternative for the linearization of problem (P) about φ_1 (with $\lambda = \lambda_1$) appears in the proofs.

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