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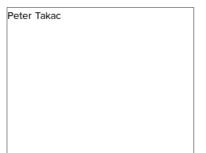
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## Analysis and Operator Theory - Peter Takac

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



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

Speaker: Peter Takac, Institut fur Mathematik, Universitat Rostock, Germany

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  $\lambda_1$  and the corresponding eigenfunction  $\varphi_1$  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

$$-\Delta_p u = \lambda |u|^{p-2} u + f(x) \text{ in } \Omega; \qquad u = 0 \text{ on } \partial \Omega.$$
 \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  $\varphi_1$  (with  $\lambda = \lambda_1$ ) appears in the proofs.



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