

# THE FREDHOLM ALTERNATIVE FOR THE $p$ -LAPLACIAN IN EXTERIOR DOMAINS. PART II

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ABSTRACT. In this talk we investigate the existence and multiplicity of solutions of the following problem

$$\begin{cases} -\Delta_p u = \lambda K(x)|u|^{p-2}u + h & \text{in } B_1^c, \\ u = 0 & \text{on } \partial B_1, \end{cases} \quad (1)$$

where  $\Delta_p u := \operatorname{div}(|\nabla u|^{p-2}\nabla u)$  is the  $p$ -Laplacian with  $p > 1$ ,  $B_1^c$  is the complement of the closed unit ball  $B_1$  in  $\mathbb{R}^N$  ( $N \geq 2$ ),  $\lambda > 0$  is a parameter, the weight  $K$  and the function  $h$  satisfy certain conditions.

By using the saddle point geometry of the energy functional and the improved Poincaré inequality obtained in Part I, we obtain multiplicity of solutions for (1) when  $1 < p < 2$  and  $2 < p < N$ , respectively employing techniques of Calculus of Variations. This work can be seen as a complement to the Fredholm alternative for the  $p$ -Laplacian in an exterior domain for the resonant case.

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This is a joint work with Pavel Drábek and Ky Ho (Department of Mathematics and NTIS, University of West Bohemia, Czech Republic).