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**Multiple solutions for semilinear elliptic boundary value problems at resonance.** (English)

Zbl 0809.35029

Electron. J. Differ. Equ. 1995, No. 01, 14 p. (1995).

Summary: In recent years several nonlinear techniques have been very successful in proving the existence of weak solutions for semilinear elliptic boundary value problems at resonance. One technique involves a variational approach where solutions are characterized as saddle points for a related functional. This argument requires that the Palais-Smale condition and some coercivity conditions are satisfied so that the saddle point theorem of Ambrosetti and Rabinowitz can be applied. A second technique has been to apply the topological ideas of Leray-Schauder degree. This argument typically creates a homotopy with a uniquely solvable linear problem at one end and the nonlinear problem at the other, and then an a priori bound is established so that the homotopy invariance of Leray-Schauder degree can be applied. In this paper we prove that both techniques are applicable in a wide variety of cases, and that having both techniques at our disposal gives more detailed information about solution sets, which leads to improved existence results such as the existence of multiple solutions.

**MSC:**

35J65 Nonlinear boundary value problems for linear elliptic equations

35J20 Variational methods for second-order elliptic equations

35D05 Existence of generalized solutions of PDE (MSC2000)

**Keywords:**

semilinear elliptic boundary value problems at resonance; Palais-Smale condition; Leray-Schauder degree

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