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Perturbed Problems Involving the Square Root of the Laplacian

We prove multiplicity of solutions for perturbed problems involving the square root of the Laplacian $\mathcal{A} = (-\Delta)^{1/2}$. More precisely, we consider the problem

$$\begin{cases} \mathcal{A}u = \lambda u + f(x, u) + \varepsilon g(x, u) & \text{in } \Omega \\ u = 0 & \text{on } \partial\Omega, \end{cases}$$

where $\Omega \subset \mathbb{R}^N$ is a bounded domain, $\varepsilon \in \mathbb{R}$, $N > 1$, f is a subcritical function with asymptotic linear behavior at infinity, and g is a continuous function. We also show the invariance under small perturbations of the number of distinct critical levels of the associated energy functional to the unperturbed problem, in both resonant and non-resonant case.

Keywords: Fractional Laplacian, variational methods, multiplicity of solutions.

MSC: 49J35, 35A15, 35S15.