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Existence of sign-changing solutions for resonant and non-resonant semilinear elliptic problems

In this talk we briefly present recent results regarding the existence of sign-changing solutions of the semilinear elliptic problem

$$\begin{cases} \Delta u + f(u) = 0 \text{ in } \Omega, \\ u = 0 \text{ on } \partial\Omega, \end{cases} \tag{1}$$

where $\Omega \subset \mathbb{R}^N$ is a smooth bounded domain and $f \colon \mathbb{R} \to \mathbb{R}$ is a nonlinear C^1-function which is also *asymptotically linear*, i.e.,

$$\lim_{|t| \to \infty} f'(t) \in \mathbb{R}. \tag{2}$$

Our results rely on two main tools: first, a precise *a priori* estimate for signed-solutions of (1). Second, an abstract Lyapunov–Schmidt reduction method, which allows us to get solutions with relatively large augmented Morse indexes. These tools are applicable to both resonant and non-resonant cases.

The most of these developments are a joint work with Alfonso Castro and Jorge Cossio.