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Section:

10. Partial Differential Equations

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Free boundary problem in the plane

In this lecture, we consider the existence of solutions of the Free bondary problem of the following type:

$$\left\{ \begin{array}{c} -\Delta\mathbf{u} = \lambda\mathbf{g}(\mathbf{u}) \quad in\Omega \\ \mathbf{u} = \mathbf{h} \quad \mathbf{on}\delta\Omega \end{array} \right\}.$$

where Ω is unitil ball in $\Re^2$, $g : \Re \to \Re$ is a function which can be discontinuous. Under suitable hypotheses, we show that there exist λ^* such that for all $\lambda > \lambda*$, there exist two solutions and we characterize their free boundaries:

$$\{\mathbf{x} \in \Omega : \mathbf{u}(\mathbf{x}) = \mathbf{1}\}$$

The value $\lambda*$ is a critical value where possible bifurcation occurs.

(*) This work is done jointly with A. Boucherif.