

## **Professor Dumitru Motreanu**

### *Lecture I: Moser Iteration Technique and Regularity*

The Moser iteration technique is presented in a unifying setting that covers simultaneously nonlinear Dirichlet and Neumann boundary value problems. It leads to show that the solutions are bounded and that a priori estimates are available. This is essentially utilized to obtain regularity results up to the boundary.

### *Lecture II: Boundary Value Problems Involving a Nonhomogeneous Operator*

The boundary value problems that we focus on involve nonlinear elliptic equations driven by a possibly nonhomogeneous operator in the gradient of the solution. In this way we go beyond the usual differential operators such as the  $p$ -Laplacian. The main difficulty consists in studying the spectral properties. The case where a variational structure exists is examined in more detail.

### *Lecture III: Smooth Minimizers Versus Sobolev Minimizers*

The celebrated topic of smooth minimizers versus Sobolev minimizers is discussed in the general setting of nonlinear boundary value problems driven by possibly nonhomogeneous differential operators. In our approach the regularity results play a major part. The obtained result allows one to pass from statements of smooth functions to statements on Sobolev spaces.

### *Lecture IV: Multiple Solutions for Nonlinear Elliptic Problems*

In the context of nonlinear boundary value problems driven by possibly nonhomogeneous differential operators we present a multiplicity result. Specifically, the existence of at least two positive solutions is guaranteed. Here the result regarding smooth minimizers versus Sobolev minimizers is of prime importance.

