LECTURES ON THE p-LAPLACE OPERATOR

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ABSTRACT. The p-harmonic operator $\operatorname{div}(|\nabla u|^{p-2}\nabla u)$ appears in many contexts. This fascinating relative of the ordinary Laplacian also has applications, for example to quasiconformal mappings, to non-linear potential theory, where the corresponding variational integral defines the p-Capacity, and to "eigenvalues". In Physics it describes certain non-Newtonian fluids. My lectures aim at some basic understanding of

- The p-Laplace Equation $\nabla \cdot (|\nabla u|^{p-2}\nabla u) = 0$.
- The p-Poisson equation.
- The eigenvalue problem $\nabla \cdot (|\nabla u|^{p-2}\nabla u) + \lambda|u|^{p-2}u = 0$ and its limit as $p \to \infty$.
- Viscosity solutions.

Succinct proofs are given of selected theorems.

Some knowledge of partial differential equations is needed to follow the lectures. Familiarity with first order Sobolev spaces is an advantage.