Departamento de Matemática Aplicada

momat

Instituto de Matemática Interdisciplinar

SEMINARIO DE MATEMÁTICA APLICADA

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Do not worry about elliptic and parabolic problems with $W^{1,1}$ estimates: sometimes it is posible to be happy

Let Ω be a bounded open set in R^N, $N \geq 2$. Consider the Dirichlet problem with $1 < p < N$, $0 < \alpha \leq a(x) \leq ß$,

$$A(u) = -\operatorname{div}(a(x)|\operatorname{grad}(u)|^{p-2}\operatorname{grad}(u)) = f(x), \quad \text{in } \Omega;$$
$$u = 0, \quad \text{on } \partial\Omega;$$

The existence of $W_0^{1,p}(\Omega)$ solutions fails if the right hand side is a function $f \in L^m(\Omega)$, $m \geq 1$, which does not belong to the dual space of $W_0^{1,p}(\Omega)$: it is possible to find distributional solutions (joint papers with T. Gallouet, past century) in function spaces "larger" than $W_0^{1,p}(\Omega)$, but contained in $W_0^{1,1}(\Omega)$.

Recently, we proved the existence (again jont paper with T. Gallouet) of $W_0^{1,1}(\Omega)$ distributional solutions in some borderline cases (ex: $f \in L^m(\Omega)$, $m = N/(N(p-1)+1)$, $1 < p < 2 - 1/N$). There is a work in progress (with Thierry Gallouet and Luigi Orsina) concerning parabolic problems. Note that the presence of a lower order term changes the results.

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