H^2 REGULARITY FOR THE $p(x)-$LAPLACIAN IN TWO-DIMENSIONAL CONVEX DOMAINS

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In an image processing problem, the aim is to recover the real image I from an observed image ξ of the form $\xi = I + \eta$, where η is a noise. In [1], the authors introduce a model that involves the $p(x)-$Laplacian (i.e $\Delta_{p(x)} u = \operatorname{div}(|\nabla u|^{p(x)-2} \nabla u)$), for some function $p : \Omega \to [p_1, 2]$, with $p_1 > 1$. More precisely, they minimize in $W^{1,p(\cdot)}(\Omega) \cap L^2(\Omega)$ the functional

$$\int_\Omega |\nabla u|^{p(x)} + \frac{\lambda}{2} \int_\Omega |u - \xi|^2 \, dx,$$

where λ is a parameter and the function $p(x)$ encodes the information on the regions where the gradient is sufficiently large (at edges) and where the gradient is close to zero (in homogeneous regions). In this manner, the model avoids the *staircasing* effect still preserving the edges.

Motivated by this application and to its applications to prove the rate of convergence for the associated continuous Galerkin Finite Element Method in the two dimensional case, we study some Sobolev regularity results of the solutions.

In particular, in this talk we disuse how we can prove the H^2 regularity of the solutions in the two dimensional case, when the domain is regular or convex.

This is a joint work with L. M. Del Pezzo.

References

[1] Yunmei Chen, Stacey Levine, and Murali Rao, *Variable exponent, linear growth functionals in image restoration*, SIAM J. Appl. Math. **66**, no. 4, (2006) 1383–1406 (electronic).

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