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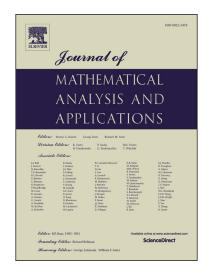
PII: S0022-247X(17)30441-9

DOI: http://dx.doi.org/10.1016/j.jmaa.2017.05.004

Reference: YJMAA 21365

To appear in: Journal of Mathematical Analysis and Applications

Received date: 12 January 2017



Please cite this article in press as: Y. Karagiorgos, N. Yannakakis, A Neumann problem for the p(x)-Laplacian with p=1 in a subdomain, J. Math. Anal. Appl. (2017), http://dx.doi.org/10.1016/j.jmaa.2017.05.004

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## **ACCEPTED MANUSCRIPT**

# A Neumann problem for the p(x)-Laplacian with p = 1 in a subdomain

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#### Abstract

In this paper we study a Neumann problem with non-homogeneous boundary conditions for the p(x)-Laplacian. In particular we assume that  $p(\cdot)$  is a step function defined in a domain  $\Omega$  and equals to 1 in a subdomain  $\Omega_1$  and 2 in its complementary  $\Omega_2$ . By considering a suitable sequence  $p_k$  of variable exponents such that  $p_k \to p$  and replacing p with  $p_k$  in the original problem, we prove the existence of a solution  $u_k$  for each of those intermediate ones. We also show, that under a hypotheses concerning the boundary data g, the limit of the sequence  $(u_k)$  is a function u, which belongs to the space of functions of bounded variation and is a solution to the original  $p(\cdot)$ -problem.

Keywords: Neumann problem, p(x)-Laplacian, 1-Laplacian, BV space. 2000 MSC: 35J20, 35J60

#### 1. Introduction

Consider the following Neumann problem

$$\begin{cases}
-\Delta_{p(x)}u(x) = 0, & x \in \Omega \\
|\nabla u(x)|^{p(x)-2}\frac{\partial u}{\partial \nu}(x) = g(x), & x \in \partial\Omega,
\end{cases}$$
(P)

where  $\Omega \subset \mathbb{R}^N$  is a bounded smooth domain and  $N \geq 2$ .

$$\Delta_{p(x)}u := \operatorname{div}(|\nabla u|^{p(x)-2}\nabla u)$$

is the p(x)-Laplacian operator which is the variable exponent version of the p-Laplacian. Also,  $g \in L^{\infty}(\partial\Omega)$  and satisfies  $\int_{\partial\Omega} g \, d\mathcal{H}^{N-1} = 0$ . Note that this latter condition is necessary, since otherwise problem (P) has no solution.

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