Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **31 (2024)** 45-57
 http://www.watam.org

ON THE STUDY OF HYPERBOLIC $P(.)$ −BI-LAPLACE EQUATION WITH VARIABLE EXPONENT

Abderrazak Chaoui

Department of Mathematics
Faculty of Sciences.
University 8 May 1945
B.P. 401, 24000, Guelma. Algeria.
Corresponding author. Tel. : +213 671317393

E-mail address: chaoui_math@yahoo.fr or ablazek2007@yahoo.com

Abstract. A high-order hyperbolic $p(.)$ −bi-Laplace equation with variable exponent is studied. The well-posedness at each time step of the problem in suitable Lebesgue Sobolev spaces with variable exponent with the help of nonlinear monotone operators theory is investigated. Some a priori estimates are proved, from which we extract convergence and existence results using Galerkin-finite element method.

Keywords. Wave $p(.)$ −Bilaplace equation, Galerkin method, weak solution.

2010 Mathematics Subject Classification : 35G30, 35G05, 65N30.

1 Introduction

We consider a bounded open domain Ω of $\mathbb{R}^n$, with a Lipschitz-continuous boundary $\partial\Omega$ and $I = [0, T]$, $T \in \mathbb{R}$. Our aim is to prove the existence and uniqueness of weak solution u and some a priori error estimates to the following hight order wave problem

$$\frac{\partial^2 u}{\partial t^2} + \triangle\left(div\left(|\triangle u|^{p(x)-2}\nabla u\right)\right) = f \qquad \text{in } \ I \times \Omega \tag{1}$$

$$u = 0, \quad \nabla u = 0 \ \text{ on } \Sigma = I \times \ \partial\Omega \tag{1_a}$$

$$u(0, x) = u_0, \ \frac{\partial u}{\partial t}(0, x) = U_1 \text{ on } \Omega \tag{1_b}$$

where f is contiuous function satisfies

$$|f(s, x)| \leq g(x) + c|s|^r$$