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EXISTENCE AND STABILITY OF A NONLINEAR VISCOELASTIC POROUS SYSTEM WITH VARIABLE EXPONENT SUBJECT TO BOUNDARY OUTPUT FEEDBACK CONTROL

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Abstract. The objective of this work is to investigate the stability properties of a one-dimensional nonlinear viscoelastic porous medium characterized by spatially variable exponents. The system under consideration is clamped at one end, while boundary control through output feedback is imposed at the opposite end. We establish the existence of weak solutions via a Galerkin approximation scheme and conduct a detailed analysis of the system's energy dissipation over time.

Keywords. Boundary output feedback control; Energy decay; Galerkin approximation scheme; Viscoelastic porous system; Variable exponent.

AMS (MOS) subject classification: 35B40, 93D20; 35L70; 35L72.

1 Introduction

The study of elastic and viscous materials with voids (porous materials) has garnered growing attention in recent years, driven by the exceptional properties of these materials in modeling a wide range of applications. Examples include geophysics, biomechanics (such as bones and skin), geological materials like rocks and soils, and manufactured products such as ceramics and compacted powders (see [4], [5], [12], [21]).

Understanding and studying the stability of solutions for problems involving these materials is of utmost importance. Such studies provide critical insights into the bounded properties of various physical systems, helping industries prevent failures and accidents. Moreover, they contribute to extending the lifespan of machinery and improving its efficiency.

These materials have sparked significant interest among researchers in various fields, resulting in a wide range of studies focused on their behavior. Many of these studies have explored mathematical challenges, including