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GENERAL STABILITY FOR A NEUTRAL DELAYED POROUS-ELASTIC SYSTEM

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Abstract. In this article, we consider a one-dimensional porous-elastic system with distributed delay of neutral type and a nonlinear damping term. First, we give an existence and uniqueness result of the solution by using the Faedo–Galerkin method. Then, using the multipliers method with some assumptions on the kernel of the neutral delay term and certain properties of convex functions, we show that the dissipation given only by the nonlinear damping term is strong enough to control the effects produced from this type of delay which is a more general class than the classical delay. We establish a general stability of the solutions for the case of equal speeds of wave propagation.

Keywords. General decay, porous-elastic system, neutral delay, multipliers method, Faedo–Galerkin approximations.

AMS (MOS) subject classification: 35L70, 35B40, 93D20, 74D05, 93D15.

1 Introduction

In the present work, we consider the following porous-elastic system with nonlinear damping term and subject to a distributed delay of neutral type

$$\begin{cases} \rho u_{tt} - \mu u_{xx} - b\phi_x = 0, \ x \in (0,1), \ t > 0, \\ J\left(\phi_t + \int_0^t k(t-s)\,\phi_t(s)\,ds\right)_t - \delta\phi_{xx} + bu_x + \xi\phi \\ +\alpha(t)\,g(\phi_t) = 0, \ x \in (0,1), \ t > 0, \\ u(x,0) = u_0(x), \ u_t(x,0) = u_1(x), \ x \in (0,1), \\ \phi(x,0) = \phi_0(x), \ \phi_t(x,0) = \phi_1(x), \ x \in (0,1), \\ u_x(0,t) = u_x(1,t) = \phi(0,t) = \phi(1,t) = 0, \ t > 0, \end{cases} \tag{1.1}$$

where the functions u and ϕ represent, respectively, the displacement of the solid elastic material and the volume fraction. The parameter ρ designate