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WELL-POSEDNESS AND DECAY ESTIMATES FOR A PETROVSKY EQUATION WITH A NONLINEAR STRONG DISSIPATION

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Abstract. A nonlinear Petrovsky equation in a bounded domain with a strong dissipation is considered

$$\partial_{tt}u + \Delta^2 u - \sigma(t)g(\Delta\partial_t u) = 0.$$

The paper concerns the existence of unique solution by using the energy method combined with the Faedo-Galerkin procedure under assumption on dissipation function g. Furthermore, the asymptotic behaviour of solutions using the multiplied method is shown.

Keywords. Well-posedness, general decay, multiplier method, convexity, Petrovsky equation.

AMS (MOS) subject classification: 35B40, 35B45, 35L70.

1 Introduction

Let Ω is a bounded domain in $\mathbb{R}^n$, with smooth boundary Γ, let $u(x,t) = u$. Initial-boundary value problem for the nonlinear Petrovsky equation is considered

$$\begin{cases} \partial_{tt}u + \Delta^2 u - \sigma(t)g(\Delta\partial_t u) = 0, & x \in \Omega, t \geq 0, \\ u = \Delta u = 0, & x \in \Gamma, t \geq 0, \\ u = u_0(x), \ , \ u_t = u_1(x) & x \in \Omega, t = 0, \end{cases} \tag{1}$$

where (u_0, u_1) is the initial data in a suitable function space, g is real function satisfying some conditions to be specified later and σ is a positive function. In **[6]**, Guesmia considered the following problem

$$\begin{cases} \partial_{tt}u + \Delta^2 u + q(x)u + g(\partial_t u) = 0 & x \in \Omega, t > 0 \\ u = \partial_\nu u = 0 \text{ in} & x \in \Gamma, t > 0 \\ u = u_0(x), \quad u_t = u_1(x), & x \in \Omega, t = 0, \end{cases} \tag{2}$$

where g is continuous, increasing, satisfying $g(0) = 0$ and $q : \Omega \longrightarrow \mathbb{R}_+$ is a bounded under suitable growth conditions on g, decay results for weak, as well as