NUMERICAL ANALYSIS FOR A LAMINATED TIMOSHENKO'S BEAM WITH INTERNAL DAMPING AND LOGARITHMS SOURCE TERMS

Abstract. This manuscript deals with a laminated Timoshenko system with interfacial slip with damping and nonlinearity logarithms source. The existence and stability of the solution are analyzed taking into account the competition of the internal damping versus the logarithmic source. We use the potential well theory. For initial data in the stability set created by the Nehari surface, the existence of global solutions is proved by using Faedo-Galerkin's approximation. The exponential decay is given by the Nakao theorem. A numerical approach is presented to illustrate the results obtained.

The laminated Timoshenko system is a model widely studied in the scientific community for vibrations of elastic beams. Its mathematical formulation is given by a system of two partial differential equations

$$
\begin{aligned}
&\rho_1\varphi_{tt} + G(3s-\xi-\varphi_x)_x + \varphi_t = \mathcal{F}_1(\varphi,\xi,s) \quad \text{in } (0,L)\times(0,\infty),\\
&\rho_2\xi_{tt} - D\xi_{xx} - G(3s-\xi-\varphi_x) + \xi_t = \mathcal{F}_2(\varphi,\xi,s) \quad \text{in } (0,L)\times(0,\infty),\\
&3\rho_2 s_{tt} - 3Ds_{xx} + 3G(3s-\xi-\varphi_x) + 4\sigma s + s_t = \mathcal{F}_3(\varphi,\xi,s) \quad \text{in } (0,L)\times(0,\infty),
\end{aligned}
$$

where the functions φ, ξ and s depending on $(x,t)\in(0,L)\times(0,T)$ model the transverse displacement of a beam with reference configuration $(0,L)\subset\mathbb{R}$ are transverse displacement and the rotations in the transverse sections, respectively. The constants, ρ is the mass density, A the cross-sectional area and I the moment of inertia. To simplify the notation let us denote by $\rho_1=\rho A$, $\rho_2=\rho I$, $\kappa=kAG$ and $b=EI$. In our work we consider a structure with iternal damping and logarithims fonts given by

$$
\begin{aligned}
\mathcal{F}_1(\varphi,\xi,s) &= \varphi|^{r-2}\varphi\ln|\varphi|_{\mathbb{R}},\ r>2\\
\mathcal{F}_2(\varphi,\xi,s) &= \xi|^{r-2}\xi\ln|\xi|_{\mathbb{R}},\ r>2\\
\mathcal{F}_3(\varphi,\xi,s) &= s|^{r-2}s\ln|s|_{\mathbb{R}},\ r>2
\end{aligned}
$$

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