ADMISSIBLE INERTIAL MANIFOLDS FOR ABSTRACT NONAUTONOMOUS THERMOELASTIC PLATE SYSTEMS

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Abstract: *In this paper, we prove the existence of admissible inertial manifolds for the nonautonomous thermoelastic plate systems*

$$\begin{cases} u_{tt} - \mu A\theta + A^2 u &= f(t,u) \\ \theta_t + \eta A\theta + \mu A u_t &= 0 \end{cases}$$

when the partial differential operator A is positive definite and self-adjoint with a discrete spectrum and the nonlinear term f satisfies $\varphi-$Lipschitz condition.

Keywords: *Thermoelastic plate, Lyapunov-Perron method, inertial manifold.*

1. Introduction

One of effective approaches to the study of long - time behavior of infinite dimensional dynamical systems is based on the concept of inertial manifolds which was introduced by C. Foias, G. Sell and R. Temam (see [4] and the references therein). These inertial manifolds are finite dimensional Lipschitz ones, attract trajectories at exponential rate. This enables us to reduce the study of infinite dimensional systems to a class of induced finite dimensional ordinary differential equations.

In this paper, on the real separable Hilbert space $\mathcal{H}$, we study the existence of admissible inertial manifolds of the nonautonomous thermoelastic plate systems:

$$\begin{cases} u_{tt} - \mu A\theta + A^2 u &= f(t,u) \\ \theta_t + \eta A\theta + \mu A u_t &= 0 \end{cases} \tag{1.1}$$

with initial data $u(0) = u_0, u_t(0) = u_1, \theta(0) = \theta_0.$

Here, μ, η are positive constants, A is a positive definite, self-adjoint operator with a discrete spectrum; i.e., there exists the orthonormal basis $\{e_k\} \in \mathcal{H}$ such that

$Ae_k = \lambda_k e_k,\ 0 < \lambda_1 \le \lambda_2 \le \dots,$ each with finite multiplicity and $\lim_{k\to\infty} \lambda_k = \infty.$

Futhermore, f be a φ - Lipschitz function which is defined as in Definition 2.7.

2. Admissible inertial manifolds

2.1. The fundamental concepts of function spaces and admissibility

Now, we first recall some notions on function spaces and refer to [8] for concrete applications. Denote by $\mathcal{B}$ the Borel algebra and by λ the Lebesgue measure on $\mathbb{R}$. The space $L_{1,loc}(\mathbb{R})$ of real-valued locally integrable functions on $\mathbb{R}$ (modulo λ - nullfunctions)

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