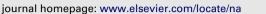
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Nonlinear Analysis



Pullback attractors for a non-autonomous generalized 2D parabolic system in an unbounded domain

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1. Introduction

In this paper, we study the dynamical behavior of a non-autonomous generalized 2D parabolic system in an unbounded domain. Let Ω_0 be a bounded open subset in \mathbb{R} , $\Omega = \Omega_0 \times \mathbb{R}$ with boundary $\partial \Omega$. Consider a non-autonomous generalized 2D parabolic system

$$-\Delta u_t + \alpha^2 \Delta^2 u_t + \nu \Delta^2 u + \nabla \cdot \vec{F}(u) + B(u, u) = g(x, t) \quad \text{in } \Omega \times [\tau, \infty),$$

$$u = \nabla u = 0 \quad \text{on } \partial \Omega \times [\tau, \infty),$$

$$u(x, \tau) = u_\tau(x) \quad \text{in } \Omega,$$
(1.1)

where $u_t = \frac{\partial u}{\partial t}$, α , ν are positive constants, \overrightarrow{F} is a nonlinear vector function, g is an external forcing term with $g \in L^2_{loc}$ ($\mathbb{R}, L^2(\Omega)$) and $B(u, u) = \frac{\partial u}{\partial x_2} \frac{\partial \Delta u}{\partial x_1} - \frac{\partial u}{\partial x_1} \frac{\partial \Delta u}{\partial x_2}$. If $\overrightarrow{F} \equiv 0$ in (1.1), the system is 2D Navier–Stokes–Voight equation. Navier–Stokes-Voight equation was introduced by Oskolkov [1] to describe a Kelvin–Voight viscoelastic incompressible fluid. Many authors have treated the autonomous Navier–Stokes–Voight equation in bounded domains [2,3] and in unbounded domains [4] from various points of view. When the domain is unbounded, the Sobolev embedding is no longer compact. This gives a difficulty for proving the existence of a global attractor. For some PDEs, such difficulty can be overcome by the energy approach, which is introduced by Ball [5,6]. Polat [7] established the existence of a global attractor to the autonomous problem (1.1), that is, when g is independent of time t, in the unbounded domain by using the technique

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ABSTRACT

The existence of a pullback attractor is proven for a non-autonomous generalized 2D parabolic system in an unbounded domain. The asymptotic compactness of the solution operator is obtained by the uniform estimates on the tails of solutions.

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