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EXISTENCE AND UNIQUENESS FOR VISCOUS BOUSSINESQ SYSTEM IN ABSTRACT BANACH SPACES

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Abstract. In this paper we study the viscous Boussinesq system in abstract Banach spaces. We prove the existence and uniqueness for global in time solutions using standard tools based on the Picard iteration technique, completed by Banach Fixed Point Theorem. Moreover, we show some properties of the asymptotic behavior for these solutions and also provide a decay rate for them.

Keywords. Boussinesq system, abstract Banach spaces, large time asymptotics.

AMS (MOS) subject classification: 35K55, 35B40, 35K15.

1 Introduction

In the natural convective transfer, the heat is transported between a solid surface and a fluid that moves over it. The fluid motion can be either turbulent or laminar, however because of the low temperatures in the natural convection, the laminar fluid occurs in the most of the cases. We refer to the reader to [7], [1] for more information about heat transport problem. Putting all the physical constant equal to 1 in the model presented in [7], we have the following system equations that represents the phenomena described above

$$\begin{aligned} v_t + (v \,.\, \nabla)v + \nabla p &= \triangle v - \gamma T + F, \\ \nabla \,.\, v &= 0, \\ T_t + v \,.\, \nabla T &= \triangle T, \\ v(0,x) = v_0(x),\ T(0,x) &= T_0(x), \end{aligned} \tag{1}$$

named viscous Boussinesq system. In this model, $t \in [0,\infty)$ is the time variable, $x \in \mathbb{R}^3$ is the space variable, $v(t,x)$ is the unknown velocity of the fluid, $T(t,x)$ is the unknown temperature of the fluid, $p(t,x)$ is the unknown pressure of the fluid, $F = F(t,x)$ is a given external force, $\gamma \in \mathbb{R}^3$ is the constant vector proportional to the thermal expansion coefficient of the fluid and to the gravitational force, v_0 and T_0 are given initial conditions.