WAVEFRONTS IN NONLOCAL REACTION-DIFFUSION SYSTEMS WITH STATE-DEPENDENT TIME DELAY

Ruijun Xie[1,2], Rong Yuan[1] and Yi Zhang[3]

[1]School of Mathematical Sciences
Beijing Normal University, Beijing, P. R. China

[2] Institute of Statistics and Applied Mathematics
Anhui University of Finance & Economics, Bengbu, P. R. China

[3]School of Science
China University of Petroleum (Beijing), Beijing, P. R. China
Corresponding author email: xieruijun@mail.bnu.edu.cn

Abstract. This paper is concerned with travelling wavefronts in nonlocal reaction-diffusion systems with state-dependent time delay, which is assumed to be an increasing function of the population density with lower and upper bound. We properly introduce the non-locality into diffusive system, and establish the existence of traveling waves by constructing a pair of upper–lower solutions and Schauder's fixed point theorem. Furthermore, qualitative properties of traveling wavefronts, such as asymptotic behavior, monotonicity are shown. The present study is continuation of a previous work that highlights the Laplacian diffusion.

Keywords. Nonlocality; State-dependent delay; Traveling wavefronts.

AMS (MOS) subject classification: 35A07, 35A18, 35K57.

1   Introduction

As discussed in [15, 16] and their references, state–dependent delay is more realistic than constant delay in describing the population dynamics, for example Antarctic whale and seal populations in [11] and the duration of larval development of flies in [6]. For the interesting phenomenon, many authors investigated state–dependent time delayed population model in [1, 2, 4, 5, 13, 15, 16, 24]. In fact, the state-dependent delay measures the intraspecific competition effects of a species. Since the limited food resources made the species individuals devote more energy and time to finding food for their own survival and virtually none to reproduce, and the time to maturity certainly becomes longer. When intraspecific competition occurs, how species move, distribute, and persist is an important biological and mathematical question. The existence of traveling wave solutions for spatial systems provide a good