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TURING AND HOPF PATTERNS FORMATION IN A PREDATOR-PREY MODEL WITH LESLIE-GOWER-TYPE FUNCTIONAL RESPONSE

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Abstract. In this paper we consider a predator-prey system modeled by a reaction-diffusion equation. It incorporates the Holling-type-II and a modified Lesie-Gower functional responses. We focus on spatiotemporal patterns formation. We study how diffusion affects the stability of predator-prey positive equilibrium and derive the conditions for Hopf and Turing bifurcation in the spatial domain.

Keywords. Predator-prey, Reaction diffusion, Bifurcations, Turing, Hopf.

AMS (MOS) subject classification: 34C23, 34C28, 34C37, 35B, 35G20, 35K55, 35Q88.

1 Introduction

The dynamic relationship between species are at heart of many important ecological and biological processes. Predator-prey dynamics are a classic and relatively well-studied example of interactions. This paper adresses the analysis of a system of this type. We assume that only basic qualitative features of the system are known, namely the invasion of a prey population by predators. The local dynamics has been studied in [2,5]. Similar model with delay is studied in [16,17], and a three dimensional similar system with the same functional responses is studied in [1,8,9]. Version with impulsive term is studied in [18]
This model incorporates the Holling-type-II and a modified Lesie-Gower functional responses.
Without diffusion, it reads as, see [2,5],

$$\begin{cases} \dfrac{dH}{dT} = \left(a_1 - b_1 H - \dfrac{c_1 P}{H + k_1}\right) H \\ \\ \dfrac{dP}{dT} = \left(a_2 - \dfrac{c_2 P}{H + k_2}\right) P \end{cases} \tag{1}$$