Review of the PhD thesis

Persistence and permanence of delay differential equations in biomathematics

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General description

The thesis concerns with some asymptotic properties of solutions of a class of non-autonomous delay differential equations, commonly arising in population dynamics and other biological models. Chapter 1 gives a short introduction, describes the structure of the thesis and the notation. Chapter 2 provides some background on the initial value problem, nonautonomous equations and numerical approximations. Chapter 3 gives new results on uniform persistence for a class of nonautonomous scalar delay differential equations. Chapter 4 considers a family of systems of nonlinear algebraic equations, and gives sufficient conditions for the existence and uniqueness of positive solutions. Chapter 5 deals with systems of delay differential equations, and gives estimates for the liminf and limsup of solutions by means of unique solutions of some algebraic systems, utilizing results from Chapter 4. Chapter 6 summarizes the results, and at the end of the thesis there is an Appendix that includes some of the technical proofs.

General evaluation

The thesis is well structured and carefully written with good English. The mathematical results on the liminf and limsup estimates, as well as on the existence of solutions of algebraic systems are improvements of the current state of the recent literature, hence the thesis is connected to and contributes to timely international research trends. Personally I found most interesting the results regarding the asymptotic equivalence of solutions of nonautonomous equations, such as Corollary 3.3.3. These results may inspire novel research directions in the future. Each key result is complemented with a large number of examples and applications, to illustrate its usefulness and applicability. I found the mathematical results new and interesting, the proofs are detailed

and seem correct. They have been published in good international journals such as *Appl Math Comput, Period Math Hung,* and one manuscript is to appear in *Discrete Cont Dyn S*.

Questions and comments

My questions and comments have been adequately addressed and the thesis has been revised accordingly during the preliminary defense process.

Summary and recommendation

Overall, in my opinion, the applicant has prepared a thesis of good quality with some novel and interesting mathematical results. The key results of the thesis have been published (or being in review) in prestigious international journals, and considering the level and the amount of the new scientific results, I recommend to award the PhD degree in case of a successful public defense.

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