Almost Periodically Forced Sigmoid Beverton-Holt Models

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PROJECT TITLE: ALMOST PERIODICALLY FORCED
SIGMOID BEVERTON-HOLT MODELS

By
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Proposal ID: RCEU19-MATH-TD-01

PROJECT DESCRIPTION

The proposed research will focus on studying the effects of almost periodic fluctuations upon the Sigmoid Beverton-Holt equation with or without overlapping generations. Its main goal consists of extending some of the existing results on the Sigmoid Beverton-Holt model in periodic environments. Noteworthy progress has recently been made on the study of the effects of periodic and almost periodic forcing on populations. Diagana et al. have made extensive use of dichotomy techniques to find sufficient conditions for the existence of globally attracting almost periodic solutions to some systems of difference equations. These existence results were then applied to discretely reproducing populations with and without overlapping generations. This project consists of three mains parts. The first one consists of investigating the stability and the existence of solutions to the Sigmund Beverton-Holt model in almost periodic environments. The second part consists of studying whether the almost periodic fluctuation of both the carrying capacity and the survival rate would yield resonance or attenuance. The third part will be devoted to the study of a stochastic Sigmund Beverton-Holt model in almost periodic environments. This proposal can be seen as a multidisciplinary task since it requires various subareas of mathematical analysis, computational modeling, and the understanding of biological systems.

The proposed research project is very important as it enhances our understanding of various key issues arising in mathematical biology (population dynamics, spread of diseases, etc.). The exposure of students in these very rapidly growing multidisciplinary topics is very important as it provides them with the opportunity to get involved in more cutting-edge research.

STUDENT DUTIES, CONTRIBUTIONS, AND OUTCOMES
STUDENT BACKGROUND

The student should be a either a math major who has some notions of biology or a biology major who has a strong background in mathematics. The student should have a 3.3 GPA in her/his math courses.

STUDENT DUTIES

The student researcher will be working from 35 to 40 hours per week during 10 weeks in summer 2019. The first task consists of studying the Beverton-Holt model. Next, the student researcher will dedicate 8 weeks to the development of the project: survey of related works, initiation and development of the methodology, and a one-week intensive collaboration with Dr. Diagana.

OUTCOMES

The results, preliminary or otherwise, will be organized in various talks to be presented during the academic year 2019-2020 in appropriate seminars within the department of mathematical sciences or the biology department etc. These talks will be designed for a broader audience.

MENTORSHIP

Dr. Diagana (mentor) will be introducing the background to the student researcher during the first two weeks. After that, the mentor will meet with the student researcher as needed. There will be a one-week of intensive collaboration between the mentor and the student researcher. The final results will be reviewed by the mentor. Publishable results will be written un LaTex and sent to appropriate journals for publication.