

Towards a theory of global dynamics in difference equations: Application to population dynamics

Saber Elaydi

Trinity University, San Antonio, USA

selaydi@trinity.edu

Global dynamics of difference equations/discrete dynamical systems are the most challenging problems in these disciplines. In this talk, we will explore some of the recent breakthroughs and advances in this area. The global dynamics of two types of discrete systems (maps) have been successfully established. These are triangular difference equations (maps) and monotone discrete dynamical systems (maps). We establish a general dynamical theory of triangular maps with minimal conditions. Smith's theory of planar monotone discrete dynamical systems is generalized via a new geometric theory to any finite dimension. Then we show how to establish global dynamics for maps that are neither monotone nor triangular via singularity theory and the notion of critical curves.

Applications to hierarchical competition models as well as predator-prey models will be discussed.