Reliable separatrix calculation in competing population models

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We will provide a broad overview of some recent research topics in biomathematics that involve questions in approximation theory.

In particular we will focus on models for the study of population systems with interactions and competition, possibly leading to extinction of some of the actors on the scene, [1, 4]. When multiple stable equilibria are simultaneously present in the system, the trajectories will evolve toward the equilibrium in the basin of attraction of which they are lying. In these cases it is fundamental to assess the present status of the system in order to establish its possible future evolution and prevent undesirable outcomes.

To achieve this goal, it is necessary to accurately and reliably compute the separation surfaces between these basins. Recent work enables us to positively answer this task, [2, 3].

In some other cases it is instead important to assess the locus of the equilibria in the parameter space, accurately computing it, to prevent possible unwanted behaviors, which may occur due to parameter perturbations induced by climatic or environmental changes, [6].

We will illustrate these techniques, some of the problems from which they arise, and the consequences that they entail for some real-life ecosystems. Among the latter are, for instance, management of natural parks, [7, 8], with some relevant issues about the interplay of fauna and flora, [6], or biological invasions, e.g. the American grey squirrel (Sciurus carolinensis Gmelin, 1788) slowly replacing the indigenous red squirrel (S. vulgaris (Linnaeus, 1758)) in northern Italy and Britain, [5].

References


