

Abstract

In population dynamics, the diffusive McKendrick–von Foerster system plays a vital role in modeling the evolution of structured populations comprising both immature and mature individuals. In this work, we propose a numerical method to address a multiple-coefficient inverse problem for this system. In particular, our method is aimed to simultaneously reconstruct four coefficients: the natural death rates of both population groups, the recruitment rate, and the initial distribution of mature individuals. Our inverse approach is based on some special transformations and the use of the Fourier–Klibanov basis, which together yield a nonlinear bi-directional ODE–PDE system. This system is then approximated using the variational quasi-reversibility method, which is designed using a suitable pair of perturbing and stabilized operators, along with associated conditional energy estimates. In this work, we prove that the approximation of the immature individuals converges at a Lipschitz rate, whereas the approximation of the mature ones converges at a Hölder rate. The latter convergence rate represents a significant extension of earlier studies on the variational quasi-reversibility inversion. Finally, some numerical examples are presented to show how the proposed inversion works.