

Inverse Problem for some Biological Models

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We consider three kind of microbiome mathematical models using diffusion-reaction systems of equation with nonlinear and nonlocal terms. The first system is an intestinal crypt model including microbiota-derived regulations. The simplified model considers a coupled system of 2 degenerate parabolic equations with cross diffusion whose unknowns are the density of progenitor cells (pc) and stem cells (sc). Additionally, the density of deep crypt secretory (DCS) cells acts as a function that we can assume to be known and that is known to affect the population dynamics in the crypt. The inverse problem consists in determining the parameters that define the shape of the density function of the DCS cells (slopes and position), from partial measurements of stem and progenitor cells. For this, we propose a classical method of adjoint state. The second model corresponds to a size-structured population of adipocyte cells storing lipids, and his inverse problem corresponds to the identification of some parameters acting on the nonlocal reaction term. The third model corresponds to an ovogenesis size-structured population model.

In Special Session 19 on Nonlinear Evolution Equations: Trends in Control Theory and Related Topics at the Mathematical Congress of the Americas 2025.