

Upscaling from Discrete to Continuous Mathematical Models of two Interacting Populations

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Populations interact in a wide variety of ways: through cooperation, competition, or predation. In this work we consider two interacting populations, individuals and a stimulus. Individuals move in response to the stimulus population while the stimulus only diffuses. Both populations grow while the stimulus population is being depleted by the individuals. In order to account for the random nature of the system, an individual-based model (IBM) is first developed and then upscaled into a continuous partial differential equation (PDE) model by considering transition probabilities of the individuals at each site. Finally, a set of numerical experiments is presented showing very good agreement between the IBM and the PDE model.