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Migration in branching processes: An overview with open problems

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Branching processes with migration and control mechanisms play a fundamental role in modeling population dynamics, genetic evolution, and stochastic processes in various applied fields. While a lot is known about their theoretical properties, incorporating migration and control functions introduces significant complexity, particularly in statistical inference. Estimating key parameters remains a challenge due to data limitations and structural dependencies within the process.

We will review key developments in the study of controlled branching processes with migration, emphasizing probabilistic results and statistical challenges. Open questions and potential directions for future research are also discussed, highlighting gaps in existing methods and the need for new approaches.

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