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Optimization of spatial control strategies for population replacement, application to *Wolbachia*. (English) Zbl 1471.92250

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Summary: In this article, we are interested in the analysis and simulation of solutions to an optimal control problem motivated by population dynamics issues. In order to control the spread of mosquito-borne arboviruses, the population replacement technique consists in releasing into the environment mosquitoes infected with the *Wolbachia* bacterium, which greatly reduces the transmission of the virus to the humans. Spatial releases are then sought in such a way that the infected mosquito population invades the uninfected mosquito population. Assuming very high mosquito fecundity rates, we first introduce an asymptotic model on the proportion of infected mosquitoes and then an optimal control problem to determine the best spatial strategy to achieve these releases. We then analyze this problem, including the optimality of natural candidates and carry out first numerical simulations in one dimension of space to illustrate the relevance of our approach.

MSC:

92D25 Population dynamics (general)
92D45 Pest management
49K15 Optimality conditions for problems involving ordinary differential equations
65K10 Numerical optimization and variational techniques

Keywords:

reaction-diffusion equation; optimal control; second order optimality conditions

Software:

Ipopt

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