Almeida, Luis; **Privat, Yannick**; **Strugarek, Martin**; **Vauchelet, Nicolas**

Optimal releases for population replacement strategies: application to Wolbachia. (English)

Zbl 1421.92029

SIAM J. Math. Anal. 51, No. 4, 3170-3194 (2019).

MSC:

92D30 Epidemiology

49K15 Optimality conditions for problems involving ordinary differential equations

49J30 Existence of optimal solutions belonging to restricted classes (Lipschitz controls, bang-bang controls, etc.)

Cited in **5** Documents

Keywords:

biomathematics; ordinary differential systems; compartmental models; optimal control; bang-bang solutions

Software:

AMPL; Ipopt

Full Text: DOI

References:

[1] E. J. Balder, \textit{On equivalence of strong and weak convergence in L_1-spaces under extreme point conditions}, Israel J. Math., 75 (1991), pp. 21–47, .

[2] N. H. Barton and M. Turelli, \textit{Spatial waves of advance with bistable dynamics: Cytoplasmic and genetic analogues of Allee effects}, Am. Nat., 178 (2011), pp. E48–E75.

[3] A. Braides, \textit{A handbook of Γ-convergence}, in Handbook of Differential Equations: Stationary Partial Differential Equations, Vol. 3, M. Chipot and P. Quittner, eds., North-Holland, Amsterdam, 2006, pp. 101–213, .

[4] D. E. Campo-Duarte, D. Cardona-Salgado, and O. Vasilieva, \textit{Establishing wMelPop Wolbachia infection among wild Aedes aegypti females by optimal control approach}, Appl. Math. Inf. Sci., 1 (2017), pp. 1–17.

[5] D. E. Campo-Duarte, O. Vasilieva, D. Cardona-Salgado, and M. Svinin, \textit{Optimal control approach for establishing wMelPop Wolbachia infection among wild Aedes aegypti populations}, J. Math. Biol., 76 (2018), pp. 1907–1950, . · Zbl 1390.92133

[6] C. Carrère, \textit{Optimization of an \textit{in vitro} chemotherapy to avoid resistant tumours}, J. Theoret. Biol., 413 (2017), pp. 24–33, .

[7] E. Caspari and G. Watson, \textit{On the evolutionary importance of cytoplasmic sterility in mosquitoes}, Evolution, 13 (1959), pp. 568–570.

[8] M. H. T. Chan and P. S. Kim, \textit{Modeling a Wolbachia invasion using a slow-fast dispersal reaction-diffusion approach}, Bull. Math. Biol., 75 (2013), pp. 1501–1523. · Zbl 1311.92173

[9] R. Cominetti and J.-P. Penot, \textit{Tangent sets to unilateral convex sets}, C. R. Acad. Sci. Paris Sér. I Math., 321 (1995), pp. 1631–1636. · Zbl 0866.49026

[10] C. Curtis and T. Adak, \textit{Population replacement in culex fatigans by means of cytoplasmic incompatibility: 1. Laboratory experiments with non-overlapping generations}, Bull. World Health Organ., 51 (1974), pp. 249–255, .

[11] G. L. C. Dutra, L. M. B. dos Santos, E. P. Caragata, J. B. L. Silva, D. A. M. Villela, R. Maciel-de Freitas, and L. Andrade Moreira, \textit{From lab to field: The influence of urban landscapes on the invasive potential of \textit{Wolbachia} in Brazilian Aedes aegypti mosquitoes}, PLoS Negl. Trop. Dis., 9 (2015).

[12] J. Z. Farkas and P. Hinow, \textit{Structured and unstructured continuous models for Wolbachia infections}, Bull. Math. Biol., 72 (2010), pp. 2067–2088, . · Zbl 1201.92044

[13] A. Fenton, K. N. Johnson, J. C. Brownlie, and G. D. D. Hurst, \textit{Solving the Wolbachia paradox: Modeling the tripartite interaction between host, Wolbachia, and a natural enemy}, Am. Nat., 178 (2011), pp. 333–342.

[14] D. A. Focks, D. G. Haile, E. Daniels, and G. A. Mount, \textit{Dynamic life table model of a container-inhabiting mosquito, Aedes aegypti (l.) (diptera: Culicidae). Part 1. Analysis of the literature and model development}, J. Med. Entomol., 30 (1993), pp. 1003–1017.

[15] R. Fourer, \textit{AMPL: A Modeling Language for Mathematical Programming}, 2nd ed., Scientific Press, San Francisco, CA, 1996.

© 2021 FIZ Karlsruhe GmbH

[16] E. Hairer, C. Lubich, and M. Roche, \textit{Error of Runge-Kutta methods for stiff problems studied via differential algebraic equations}, BIT, 28 (1988), pp. 678–700, . · Zbl 0657.65093

[17] A. Henrot and M. Pierre, \textit{Variation et optimisation de formes}, Vol. 48, Springer-Verlag, Berlin, 2005, .

[18] M. Hertig and S. B. Wolbach, \textit{Studies on Rickettsia-like micro-organisms in insects}, J. Med. Res., 44 (1924), p. 329.

[19] M. W. Hirsch and H. Smith, \textit{Monotone dynamical systems}, in Handbook of Differential Equations: Ordinary Differential Equations, Vol. 2, Elsevier, Amsterdam, 2005, pp. 239–257.

[20] A. A. Hoffmann, B. L. Montgomery, J. Popovici, I. Iturbe-Ormaetxe, P. H. Johnson, F. Muzzi, M. Greenfield, M. Durkan, Y. S. Leong, Y. Dong, H. Cook, J. Axford, A. G. Callahan, N. Kenny, C. Omodei, E. A. McGraw, P. A. Ryan, S. A. Ritchie, M. Turelli, and S. L. O'Neill, \textit{Successful establishment of Wolbachia in Aedes populations to suppress dengue transmission}, Nature, 476 (2011), pp. 454–457, .

[21] H. Hughes and N. F. Britton, \textit{Modeling the use of Wolbachia to control dengue fever transmission}, Bull. Math. Biol., 75 (2013), pp. 796–818. · Zbl 1273.92034

[22] J. Lamboley, A. Laurain, G. Nadin, and Y. Privat, \textit{Properties of optimizers of the principal eigenvalue with indefinite weight and Robin conditions}, Calc. Var. Partial Differential Equations, 55 (2016), Art. 144, . · Zbl 1366.49004

[23] H. Laven, \textit{Eradication of Culex pipiens fatigans through cytoplasmic incompatibility}, Nature, 216 (1967), pp. 383–384, .

[24] R. Lees, J. Gilles, J. Hendrichs, M. Vreysen, and K. Bourtzis, \textit{Back to the future: The sterile insect technique against mosquito disease vectors}, Insect Sci., 10 (2015), pp. 156–162.

[25] M. Otero, N. Schweigmann, and H. G. Solari, \textit{A stochastic spatial dynamicl model for Aedes aegypti}, Bull. Math. Biol., 70 (2008), pp. 1297–325. · Zbl 1142.92028

[26] J. G. Schraiber, A. N. Kaczmarczyk, R. Kwok, M. Park, R. Silverstein, F. U. Rutaganira, T. Aggarwal, M. A. Schwemmer, C. L. Hom, R. K. Grosberg, and S. J. Schreiber, \textit{Constraints on the use of lifespan-shortening Wolbachia to control dengue fever}, J. Theoret. Biol., 297 (2012), pp. 26–32, . · Zbl 1336.92085

[27] M. Strugarek and N. Vauchelet, \textit{Reduction to a single closed equation for 2-by-2 reaction-diffusion systems of Lotka-Volterra type}, SIAM J. Appl. Math., 76 (2016), pp. 2060–2080, . · Zbl 1355.35108

[28] R. C. A. Thomé, H. M. Yang, and L. Esteva, \textit{Optimal control of \textit{Aedes aegypti} mosquitoes by the sterile insect technique and insecticide}, Math. Biosci., 223 (2010), pp. 12–23, . · Zbl 1180.92058

[29] E. Trélat, J. Zhu, and E. Zuazua, \textit{Allee optimal control of a system in ecology}, Math. Models Methods Appl. Sci., 28 (2018), pp. 1665–1697. · Zbl 1411.93198

[30] A. Wächter and L. T. Biegler, \textit{On the implementation of an interior-point filter line-search algorithm for large-scale nonlinear programming}, Math. Program., 106 (2006), pp. 25–57, .

[31] T. Walker, P. H. Johnson, L. A. Moreira, I. Iturbe-Ormaetxe, F. D. Frentiu, C. J. McMeniman, Y. S. Leong, Y. Dong, J. Axford, P. Kriesner, A. L. Lloyd, S. A. Ritchie, S. L. O'Neill, and A. A. Hoffmann, \textit{The wMel \textit{Wolbachia} strain blocks dengue and invades caged Aedes aegypti populations}, Nature, 476 (2011), pp. 450–453.

[32] J. H. Werren, L. Baldo, and M. E. Clark, \textit{Wolbachia: Master manipulators of invertebrate biology}, Nat. Rev. Microbiol., 6 (2008), pp. 741–751.

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.