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FEEDBACK CONTROL PRINCIPLES FOR BIOLOGICAL CONTROL OF DENGUE VECTORS

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Controlling diseases such as dengue fever, chikungunya or zika by spreading the parasitic bacterium Wolbachia in mosquito populations which are their vectors, is considered a promising tool to reduce their spread. While description of the conditions of such experiments has received ample attention from biologists, entomologists and applied mathematicians, the effective scheduling of the releases remains an interesting issue for Control theory. Having in mind the important uncertainties on the dynamics of the two populations in interaction, we attempt here to identify general ideas for building release strategies, applicable to various models and situations. These principles are exemplified by the design of interval observer-based feedback control laws whose stabilizing properties are demonstrated theoretically and numerically when applied to a 4-dimensional ODE model retrieved from [1]. Crucial use is made of the theory of monotone systems [2, 3].

References

[1] Bliman, P.-A., Aronna, M.S., Coelho, F.C. & da Silva, M.A.H.B. (2018). *Ensuring successful introduction of Wolbachia in natural populations of Aedes aegypti by means of feedback control*, J. Math. Biol. 76(5), 1269–1300. https://doi.org/10.1007/s00285-017-1174-x

[2] Smith, H.L. (1995). *Monotone dynamical systems: an introduction to the theory of competitive and cooperative systems*. American Mathematical Society.

[3] Smith, H.L. (2017). *Monotone dynamical systems: reflections on new advances & applications*, Discrete and Continuous Dynamical Systems-A 37(1), 485–504. http://dx.doi.org/10.3934/dcds.2017020

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