On the Regional Control Of Spatially Structured Epidemic Systems. Application to a Malaria Model

Vincenzo Capasso
ADAMSS (Interdisciplinary Centre for Advanced Applied Mathematical and Statistical Sciences), Universitá degli Studi di Milano "*La Statale*", Milano, Italy

The talk will concern a unified review of a set of previous papers by the same author and collaborators concerning the mathematical modelling and control of malaria epidemics. The presentation moves from a conceptual mathematical model of malaria as a spatially structured system. Significant model reductions have been introduced, in order to make the resulting reaction-diffusion system mathematically affordable. Only the dynamics of the infected mosquitoes and of the infected humans has been included, so that a two-component reaction-diffusion system is finally taken.

The spread of the disease is controlled by three actions (controls): killing mosquitoes, treating the infected humans and reducing the contact rate mosquitoes-humans. The public health concern consists of providing methods for the eradication of the disease in the relevant population, as fast as possible. On the other hand, very often the entire domain of interest for the epidemic, is unknown, or difficult to reach for the implementation of suitable environmental sanitation programmes. This has led the authors to suggest that implementation of such programmes might be done only in a given subregion, conveniently chosen so to lead to an effective eradication of the epidemic in the whole habitat ("Think globally, act locally").

To start with, the problem of the eradicability of the disease is considered. We have proven that it is possible to decrease exponentially both the human and the vector infective population everywhere in the relevant habitat by acting only in a suitable subdomain. Later the regional control problem of reducing the total cost of the damages produced by the disease, of the controls and of the intervention in a certain subdomain is treated for the finite time horizon case. In order to take the logistic structure of the habitat into account the level set method is used as a key ingredient for describing the subregion of intervention.

REFERENCE

[1] Aniţa S., Capasso V., A stabilizability problem for a reaction-diffusion system modelling a class of spatially structured epidemic model, *Nonlinear Anal. Real World Appl.* 2002; **3**: 453–464.

[2] Aniţa S., Capasso V., Stabilization of a reaction-diffusion system modelling malaria transmission. Discrete and Continuous Dynamical Systems, Series B, 2012; **17**: 1673–1684.

[3] Aniţa S., Capasso V., Demetriu, G., Regional Control for a spatially structured malaria model. *Mathematical Methods in the Applied Sciences* 2019; **42**: 2909–2933.