Identification Parameters in a Biological Model of Immune Competition : Global Optimization and Kriging Method

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In this work, we study the problem of identifying parameters in the model of immune competition developed in ([1], [2]). Specifically, we use the approach of the inverse problem which will allow the identification of parameters from measurements of densities of two populations of cells in the proliferation case. The reformulation of the given nonlinear identification problem was considered as a parametric optimization problem using the Least Square criterion. In this work, a design procedure for global robust optimization is developed using Kriging [4] and global optimization approaches [3]. Robustness is determined by the Kriging model to reduce the number of real functional calculations of Least Square criterion. The technical of the global optimization methods is adopted to determine the global robust optimum of a surrogate model.

References

[1] A. Bellouquid, M. Delitala, *Modelling Complex Biological Systems: A kinetic Theory Approch*, Birkuser, Boston, Basel, Berlin (2006).

[2] N. Bellomo, A. Bellouquid and M. Delitala, *Mathematical Topics on the Modelling Complex Multicellular Systems and Tumor Immune Cells Competition*, Mathematical Models and Methods in Applied Sciences Vol. 14, No. 11 , 1683-1733 (2004).

[3] Donald R.Jones, Matthias Schonlau and William J.Welch *Efficient Global Optimization of Expensive Black-Box Functions* Journal of Global Optimization 13:455-492 (1998).

[4] L. Afraites, J. Hazart, P. Schiavone, *Application of the Kriging method to the reconstruction of ellipsometric signature*, Microelectronic Engineering, Vol. 86, issue 4-6, pp. 1033-1035 (2009).