The Tikhonov method in Hes1 gene expression model

Agnieszka Bartłomiejczyk
Faculty of Applied Physics and Mathematics, Gdańsk University of Technology
Gabriela Narutowicza 11/12, 80-233 Gdańsk, Poland
agnbartl@pg.edu.pl

Abstract

The Tikhonov method reduces variables of the complex systems under the assumption that some parameters are small, [4]. We consider a model of gene transcription and protein synthesis, [2, 3]. We investigate the effect of multiple binding sites in the Hes1 promoter. In the presented Hes1 gene expression model we will consider two processes: dimer formation and binding to the promoter. Using the Tikhonov theorem we simplify the entire system to the classical one in different ways depending on the time scales of the involved processes. More precisely, we prove that the solutions of the full system can be approximated by the solutions of the reduced systems, [1].

This is joint work with Marek Bodnar.

References

[1] A. Bartłomiejczyk, M. Bodnar, *Justification of quasi-stationary approximation in models of gene expression of a self-regulating protein* – submitted.

[2] M. Bodnar, A. Bartłomiejczyk, *Stability of delay induced oscillations in gene expression of Hes1 protein model*, Non. Anal. RWA, 13 (2012), 2227–2239.

[3] N.A. Monk, *Oscillatory expression of Hes1, p53, and NF-κB driven by transcriptional time delays*, Curr. Biol., 13 (2003), 1409–1413.

[4] A.N. Tikhonov, *Systems of differential equations with small parameters multiplying derivatives*, Matem. Sb. (in Russian), 27 (1948), 147–156.