SINGULAR PERTURBATION TECHNIQUES AND ASYMPTOTIC EXPANSIONS FOR AUXILIARY ENZYME REACTIONS

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The complex intracellular signal transduction networks can be decomposed into simpler moduli, where fundamental reactions, like the Goldbeter-Koshland switch (which models, for example, the phosphorylation-dephosphorylation cycle) [1, 2], the competitive inhibition [3] and the double phosphorylation mechanism [4], play fundamental roles for the cell fate. It is then fundamental to capture the analytic features of these reactions, in order to predict, in perspective, the behaviour of the networks in terms of their characteristic parameters. This is one of the main reasons for the application of the so-called total quasi-steady-state approximation (tQSSA) [5], which has gained more and more attention in the last two decades for its ability to approximate in a very efficient way the behaviour of the reactants in many enzyme reactions and for a very wide range of parameter values.

In this talk we show some recent results related to the application of singular perturbation techniques in the framework of the total quasi-steady-state approximation (tQSSA) for the approximation of the so-called auxiliary or coupled enzyme reactions [6].

We determine the uniform expansions up to the first order in terms of appropriate perturbation parameters, related to the initial conditions and to the kinetic parameters characterizing the reactions. These results can be very useful for the determination of the kinetic parameter values, by means of the interpolation of experimental data with the explicit (though approximated) formulas we found.

References

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