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Quasi-Steady State and Tikhonov's Theorem

The quasi-steady state assumption is frequently used in the analysis of differential equations for reacting systems in (bio-) chemistry, to reduce the dimension of the problem. As it turns out, the ad-hoc reduction method can be properly cast (and modified) in the framework of Tikhonov's and Fenichel's classical theorems in singular perturbation theory. Remarkably, this input of more theory yields reduced differential equations with a simpler appearance: In contrast to the ad-hoc method, the reduced differential equations will always have rational right-hand side. Some relevant examples are discussed.