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Dynamics and Stability of a 3D Model of Cell Signal Transduction with Delay

We consider a 3D model of cell signal transduction with delay. In this model, the deactivation of signalling proteins occur throughout the cytosol and activation is localized to specific sites in the cell. We use matched asymptotic expansions to construct the dynamic solutions of signalling protein concentrations. The result of the asymptotic analysis is a system of delay differential equations (DDEs). This reduced DDE system is compared to numerical simulations of the full 3D system with delay. There are delay values which give rise to sustained oscillations. We implement the method of constrained coordinates numerically to improve the asymptotic results in this case.