Sensitivity analysis of oscillatory (bio)chemical systems.

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From the cell cycle to circadian rhythms, oscillatory processes are fundamental to biology. Emerging from nonlinear dynamical interactions, oscillatory mechanisms are best understood through mathematical modeling. Ordinary differential equations (ODEs) are one framework in which the complex interactions giving rise to biological oscillations may be modeled. Key to ODE models are the model parameters that determine whether or not oscillations will occur, and the period and amplitude of the oscillations when they do. Sensitivity analysis is a means to acquire insight about the importance of the model parameters. Sensitivity analysis of oscillatory systems provides unique challenges and must be addressed carefully. In the present study, we describe a method for determining the sensitivity of the period to the model parameters that is straightforward to implement and interpret. We apply this method to a model for circadian rhythms, and obtain results suggesting a link between network structure and parameter sensitivity.