Parameter range reduction for ODE models using monotonic discretizations

We consider fitting an ODE model to dense but noisy time series data of the system variables. We assume that the parameters of the model have some initial range of possible values, and the goal is to reduce these ranges to produce the smallest possible range that is consistent with the data. To achieve this we employ certain discretizations of the differential equation which are monotonic in the sense that the vector field is always multiplied by a scalar of the same sign in the discretization. This allows us to exploit the fact that for many models, the vector field exhibits monotonic properties with respect to many of the parameters. The method can also be employed in situations where not all of the variables are measured. We illustrate the method with several examples.

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