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Parameter estimation of an S-system model using hybrid genetic algorithm with the aid of sensitivity analysis

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A biochemical system is a biological system consisting of a collection of chemical compounds interacting with each other. One way to model and analyze a biochemical system is by using S-systems, which are coupled ordinary differential equations based on power-law formalism. In this work, we do a parameter estimation on an S-system model called HS96. This model, proposed by Hlavacek and Savageau in 1996, describes a simple genetic network consisting of five dependent variables $X_i, i = 1, 2, \dots, 5$. As a preliminary method, sensitivity analysis of HS96 is conducted to investigate the change in model outputs with respect to the changes in model parameters. Usual model outputs are X_i and $\dot{X}_i, i = 1, 2, \dots, 5$. From the results of sensitivity analysis, model outputs are selected which are then used to estimate the parameters of the HS96 model. A hybrid of genetic algorithm with the interior point method is used in the parameter estimation.

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