Numerical design of robust estimators for box-photochemistry system

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Various uncertainties jeopardize numerical forecasts of various atmospheric-chemistry models which stimulate efforts to improve the accuracy of numerical forecasts by integrating limited observations and simulations. This paper presents a numerical approach to the design of feedback controlled robust estimators for multidimensional nonlinear models that are frequently used to describe photochemical reactions. Parameters of feedback control, which deliver robust tracking of directly immeasurable system states, are found via off-line minimization of error function assessing mismatches between trial and actual system trajectories. This assures efficient online simulation of complex estimator system. Extensive numerical tests show that these estimators provide rapid and robust tracking of solutions to photochemistry systems. These systems accumulate significant uncertainties in their parameters and initial values under the most conservative assumption that a concentration of single reacting specie is only measurable. We also assure our approach using the Lyapunov function method and consider its application to the problem of noise removal if available data is corrupted by noise.