

Use of the merging particle filter for the estimation of an uncertain parameter in nonlinear system models

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While Kalman-filter-like algorithms provide good parameter estimates for linear systems, it is not easy to estimate the values of uncertain parameters for nonlinear systems. In this presentation, we introduce the use of the merging particle filter (MPF) algorithm for this purpose. The MPF is an improved algorithm of the particle filter (PF), in which each posterior ensemble member is obtained by combining

several members in the prior ensemble. The MPF allows us to avoid the ensemble degeneration problem with a relatively small ensemble size. We conducted twin experiments using a simple nonlinear model. In the twin experiments, we used the PF and the ensemble Kalman filter (EnKF) as well as the MPF, and compared their performances. It is suggested

that the convergence of the PF is rather poor. It is also found that the accuracy of the EnKF is limited probably due to the existence of the nonlinearity in the system. In comparison with the other two algorithms, the MPF tends to provide a better parameter estimate.