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Kalman Filter Estimation of Identified Reduced Model Using Balanced Truncation: a Case Study of the Bengawan Solo River

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Abstract: In this paper, we compare the estimation results for the reduced model and original model of water level in a river. First, we compute a reduced model from the original model using the balanced truncation method, then we estimate the reduced model using the Kalman filter. Since the orders of the state variables in the reduced model and original model are different, we cannot compare them directly. Therefore, we need an identification of the state variables in the reduced model such that we can determine the corresponding state variables in the original model or the real data. The selected river flow model is the Bengawan Solo river in Indonesia. The Bengawan Solo river is the longest river in Indonesia and often causes floods in the area around the river. With the river length of 548 km, it is difficult to obtain complete data at each point, and this will lead to a large order river flow model. Since the Bengawan Solo river flow model is a large order model, we need to reduce the model using the balanced truncation method. Next, to obtain data on the water levels at each unknown point, we estimate the reduced model using the Kalman filter method. Based on the simulation results, we see that if more points are removed, the error value is larger. However, if fewer points are known, the computational time is less.

Keywords: *estimation; Kalman filter; model reduction; balanced truncation; Bengawan Solo river.*

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