

## Smoothed state estimates under abrupt changes using sum-of-norms regularization

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The presence of abrupt changes, such as impulsive and load disturbances, commonly occur in applications, but make the state estimation problem considerably more difficult than in the standard setting with Gaussian process disturbance. Abrupt changes often introduce a jump in the state, and the problem is therefore readily and often treated by change detection techniques. In this paper, we take a different approach. The state smoothing problem for linear state space models is here formulated as a constrained least-squares problem with sum-of-norms regularization, a generalization of  $\ell_1$ -regularization. This novel formulation can be seen as a convex relaxation of the well known generalized likelihood ratio method by Willsky and Jones. Another nice property of the suggested formulation is that it only has one tuning parameter, the regularization constant which is used to trade off fit and the number of jumps. Good practical choices of this parameter along with an extension to nonlinear state space models are given.

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