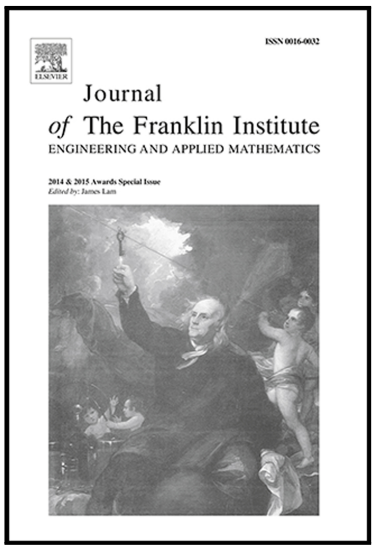

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PII: S0016-0032(17)30627-0
DOI: 10.1016/j.jfranklin.2017.11.037
Reference: FI 3247

To appear in: *Journal of the Franklin Institute*

Received date: 17 March 2017
Revised date: 3 November 2017
Accepted date: 20 November 2017

Please cite this article as: Zhe Gao, Fractional-order Kalman filters for continuous-time fractional-order systems involving colored process and measurement noises, *Journal of the Franklin Institute* (2017), doi: 10.1016/j.jfranklin.2017.11.037

Fractional-order Kalman filters for continuous-time fractional-order systems involving colored process and measurement noises

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Abstract

This study proposes fractional-order Kalman filers using Tustin generating function and the average value of fractional-order derivative to estimate the state of fractional-order systems involving colored process and measurement noises. By Tustin generating function, a fractional-order differential equation is provided to approximate the dynamics of a continuous-time fractional-order system and colored process and measurement noises. By constructing an augmented system with respect to state, the process noise and the measurement noise to deal with colored noises, the fractional-order Kalman filter using Tustin generating function is proposed to improve the estimation accuracy. Besides, the average value of fractional-order derivative is proposed, and the corresponding fractional-order Kalman filter by the augmented system method is presented to reduce estimation error. Finally, two illustrative examples are given to illustrate that the proposed two kinds of Kalman filters are more effective than fractional-order Kalman filter based on Grünwald-Letnikov definition.

Keywords: Fractional-order systems; Kalman filters; colored noises; Tustin generating function; average value of fractional-order derivative.

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