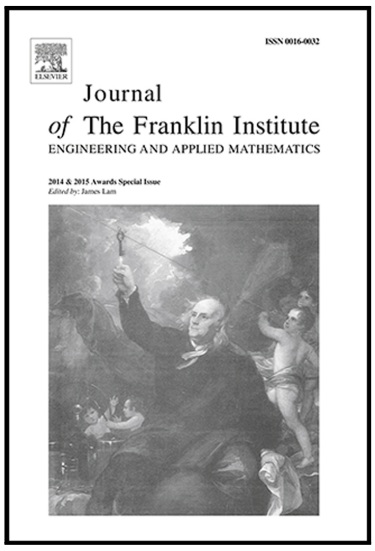

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Yonghui Sun, Yi Wang, Xiaopeng Wu, Yinlong Hu

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Robust extended fractional Kalman filter for nonlinear fractional system with missing measurements

Yonghui Sun*, Yi Wang, Xiaopeng Wu, and Yinlong Hu

College of Energy and Electrical Engineering, Hohai University, Nanjing 210098, China

Abstract

Accurate and effective state estimation is essential for nonlinear fractional system, since it can provide some vital operation information about the system. However, inevitably missing measurements and additive uncertainty in the gain will affect the performance of estimation result. Thus, in this paper, in order to deal with these problems, a novel robust extended fractional Kalman filter (REFKF) is developed for states estimation of nonlinear fractional system, by which the states can be estimated accurately even with missing measurements. Finally, simulation results are provided to demonstrate that the proposed method can achieve much better estimation performance than the conventional extended fractional Kalman filter (EFKF).

Key Words-State estimation, missing measurement, fractional system, robust extended Kalman filter.

I. INTRODUCTION

The idea of fractional calculus was firstly proposed by Leibniz and L'Hospital in 1695 [1], then in the later of 19th century, the definition of fractional derivative was expressed for the first time by Liouville and Riemann. Due to some practical systems can be modeled more accurately by using the fractional system, therefore, in recent years, much attention has been paid to investigate the dynamic properties of fractional system, such as stability analysis [2]-[3], bifurcations analysis [4], and synchronization control [5]-[7]. Furthermore, it has been widely and successfully used in many engineering aspects [8]-[12]. For example, in [8], based on a fractional order impedance spectra model, the state of charge (SOC) of Lithium-ion battery was estimated by the fractional order Kalman filter with a high accuracy. In [9], by using a fractional calculus element, the frequency dependence

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*Corresponding author: Tel.: +86-25-58099077; fax: +86-25-58099077; e-mail: sunyonghui168@gmail.com