

Accepted Manuscript

An algebraic approach to on-line signal denoising and derivatives estimation

Josip Kasac, Dubravko Majetic, Danko Brezak

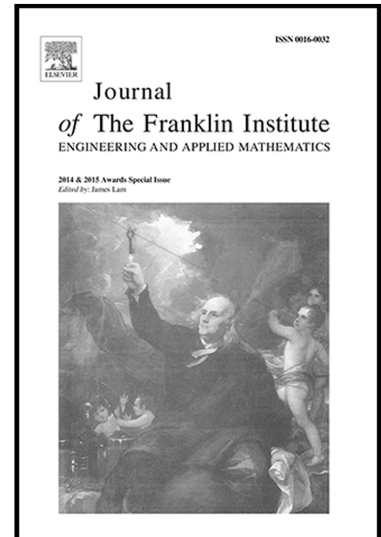
PII: S0016-0032(18)30549-0
DOI: <https://doi.org/10.1016/j.jfranklin.2018.08.016>
Reference: FI 3605

To appear in: *Journal of the Franklin Institute*

Received date: 6 February 2018
Revised date: 18 July 2018
Accepted date: 9 August 2018

Please cite this article as: Josip Kasac, Dubravko Majetic, Danko Brezak, An algebraic approach to on-line signal denoising and derivatives estimation, *Journal of the Franklin Institute* (2018), doi: <https://doi.org/10.1016/j.jfranklin.2018.08.016>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



An algebraic approach to on-line signal denoising and derivatives estimation

Josip Kasac*, Dubravko Majetic, Danko Brezak

*University of Zagreb,
Faculty of Mechanical Engineering and Naval Architecture,
I. Lucica 5, HR-10000 Zagreb, Croatia*

Abstract

In this paper, a new algebraic approach to the on-line signal derivatives estimation is proposed. The proposed approach is based on the conversion of the truncated Taylor series expansion to the set of linearly independent equations regarding the signal derivatives. The nonhomogeneous parts of the obtained set of equations are convolution integrals, which can be transformed to the stable linear state-space filter realization. The proposed algebraic estimator provides stable convergence without the need for periodic re-initialization, as in the case of the conventional algebraic estimators. In contrast to the Taylor series-based tracking differentiators, the proposed estimator also provides an estimation of the arbitrary number of the higher-order signal derivatives. In addition, the tuning of the estimator parameters does not depend on the filter dimension. The efficiency of the proposed estimator is illustrated by the simulation examples and experimental results related to the monitoring of the surgical drilling process.

Keywords: Algebraic estimation; Differentiators; Signal denoising; Linear systems; Continuous-time filters

1. Introduction

The filtering and derivatives estimation of a measured signal is necessary for many applications, such as biomechanics [1], failure diagnostics [2], signal processing [3] or control engineering [4, 5], among others. Various methods have been proposed for derivatives estimation of noisy signals. Numerical differentiation using difference methods is a well-known direct approach to compute the signal derivatives [6]. However, numerical differentiation is an ill-posed problem, which means that small errors in the measurement values may lead to large errors in the derivatives estimate [7].

*Corresponding author

Email addresses: jkasac@fsb.hr (Josip Kasac), dmajetic@fsb.hr (Dubravko Majetic), dbrezak@fsb.hr (Danko Brezak)

Download English Version:

<https://daneshyari.com/en/article/10226072>

Download Persian Version:

<https://daneshyari.com/article/10226072>

[Daneshyari.com](https://daneshyari.com)