

软件、算法与仿真

改进的基于PSE和Tustin变换的 分数阶系统求解递推算法

朱呈祥^{1,2}, 邹云¹

1. 南京理工大学自动化学院, 江苏 南京 210094; 2. 徐州师范大学电气工程及自动化学院, 江苏 徐州 221116

摘要:

以分数阶算子近似方法的分析研究为基础, 基于Tustin变换理论及其用于分数阶算子的离散生成函数公式特点, 利用二项式幂函数的Maclaurin展开能够保证收敛的特性, 考虑常用算法的局限性, 提出了一种改进的基于幂级数展开和Tustin变换的分数阶运算方法, 并应用于线性分数阶系统的求解, 给出了递推算法的详细推导。算例仿真及其分析表明, 该算法有效且具有良好的运算速度和精度。

关键词: 分数阶微积分 分数阶系统 递推算法 幂级数展开 Tustin变换

Improved recursive algorithm for fractional order system solution based on PSE and Tustin transform

ZHU Cheng xiang,ZOU Yun

1. School of Automation, Nanjing Univ. of Science & Technology, Nanjing 210094, China; 2. School of Electrical Engineering & Automation, Xuzhou Normal Univ., Xuzhou 221116, China

Abstract:

As an important and foundational work of fractional order control which is a new study field of control science and engineering, the solution method of fractional order calculus (FOC) and fractional order system (FOS) receives great attention. Based on the analysis of some aspects, such as the approximative algorithm of FOC, the Tustin transform theory and its generating function formula's character, the convergence guarantee of binomial power function by Maclaurin expanding, and the consideration of the limitation of conventional methods, an improved method is proposed to compute the numerical evaluation of FOC using PSE and Tustin transform and is further applied to solving the linear FOS. The recursive algorithm is deduced in detail, its effectiveness and advantage are verified by some illustrative simulation examples.

Keywords: fractional order calculus fractional order system recursive algorithm power series expansion Tustin transform

收稿日期 修回日期 网络版发布日期

DOI:

基金项目:

通讯作者:

作者简介:

作者Email:

参考文献:

null

本刊中的类似文章

扩展功能

本文信息

Supporting info

PDF(OKB)

[HTML全文]

参考文献[PDF]

参考文献

服务与反馈

把本文推荐给朋友

加入我的书架

加入引用管理器

引用本文

Email Alert

文章反馈

浏览反馈信息

本文关键词相关文章

分数阶微积分

分数阶系统

递推算法

幂级数展开

Tustin变换

本文作者相关文章

朱呈祥

邹云

PubMed

Article by

Article by