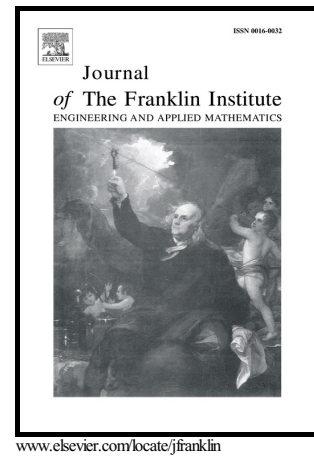


Author's Accepted Manuscript

A Constrained Linear Quadratic Optimization Algorithm toward Jerk-decoupling Cartridge Design

Jun Ma, Si-Lu Chen, Chek Sing Teo, Chun Jeng Kong, Arthur Tay, Wei Lin, Abdullah Al Mamun



PII: S0016-0032(16)30380-5
DOI: <http://dx.doi.org/10.1016/j.jfranklin.2016.10.020>
Reference: FI2763

To appear in: *Journal of the Franklin Institute*

Received date: 2 June 2016
Revised date: 28 September 2016
Accepted date: 13 October 2016

Cite this article as: Jun Ma, Si-Lu Chen, Chek Sing Teo, Chun Jeng Kong Arthur Tay, Wei Lin and Abdullah Al Mamun, A Constrained Linear Quadratic Optimization Algorithm toward Jerk-decoupling Cartridge Design, *Journal of the Franklin Institute*, <http://dx.doi.org/10.1016/j.jfranklin.2016.10.020>

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 galley proof before it is published in its final citable 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.

A Constrained Linear Quadratic Optimization Algorithm toward Jerk-decoupling Cartridge Design

Jun Ma^{a,b,c}, Si-Lu Chen^{a,b,c,*}, Chek Sing Teo^{a,b,c}, Chun Jeng Kong^c,
Arthur Tay^{a,b}, Wei Lin^{a,c}, Abdullah Al Mamun^{a,b}

^a*SIMTech-NUS Joint Lab on Precision Motion Systems, Singapore 117582*

^b*Department of Electrical and Computer Engineering, National University of Singapore,
Singapore 117583*

^c*Mechatronics Group, Singapore Institute of Manufacturing Technology (SIMTech),
Singapore 138634*

Abstract

Linear direct feed drives are widely used in machine tools, but an abrupt counter force from the secondary part will induce the jerk to the metro frame contacted with the linear motor and cause the vibration of auxiliary devices on it. The jerk-decoupling cartridge (JDC) provides a buffer to reduce such an impact. Design target for such a system includes both the tracking error and the jerk induced to the metro frame. To achieve both targets systematically, this work presents an integrated approach to efficiently determine parameters in the JDC and the position controller of the feed drive. The problem is firstly formulated as a nonlinear constrained optimization problem, which is then converted to a series of projection gradient optimization problems and step searching problems, which are either convex or linear. Thus, fast convergence of parameters are achieved within first several iterations. Through a series of simulation, the effectiveness of proposed methodology is verified.

Keywords: Feed drive, jerk, constrained optimization, convex optimization, decentralized control, linear quadratic regulator.

*Corresponding author. Tel.: +65 6510 1629.

Email address: slchen@SIMTech.a-star.edu.sg (Si-Lu Chen)

Download English Version:

<https://daneshyari.com/en/article/4974187>

Download Persian Version:

<https://daneshyari.com/article/4974187>

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