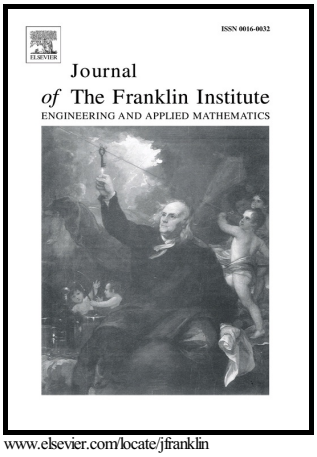


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# A Constrained Linear Quadratic Optimization Algorithm toward Jerk-decoupling Cartridge Design

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**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.

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