

Modeling Dynamics and Control of Transversal Vibration of an Underactuated Flexible Plate Using Controlled Lagrangian Method

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Abstract : The method of Controlled Lagrangian is an energy shaping control technique for under actuated Lagrangian systems. Energy shaping control design methods are appealing as they retain the underlying nonlinear dynamics and can provide stability results that hold over larger domain than can be obtained using linear design and analysis. In the present study, controlled lagrangian is employed for designing a controller in an under actuated rotating flexible plate system. In the system of rotating flexible plate, due to its nonlinear characteristics and coupled dynamics of rigid and flexible components, controller design is a known challenge. In this paper, controller objectives are considered to be vibration reduction of flexible component and position control of the tip of the plate. To achieve the goals, a method based on both kinetic and potential energy shaping is introduced. The stability of the closed-loop system is investigated and proved around its equilibrium points. Moreover, the proposed controller is shown to be robust against disturbance and plant uncertainties.

Keywords : controlled lagrangian, underactuated system, flexible rotating plate, disturbance

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