名古屋大学NLSセミナー

Institute of
Nano-Life-Systems

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「Flatness based control of 2D and 3D crane」

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(名古屋大学工学研究科3号館 333号室)

Several authors considered crane systems, both two- and three- dimensional (m-crane), and investigated their structural properties, flatness, motion planning and tracking. Independently of the dimension, these systems share common properties that can be further generalized. In this presentation, we propose a class of 2D and 3D crane control systems. We describe this class, investigate its properties and prove that these systems are feedback equivalent to a normal form, more precisely, to the second order chained form with drift. For that chained form, we prove flatness of differential weight 5*m* (where *m* is the number of controls). This presentation is organized as follows. In Section 2, we study the 2D and 3D crane and derive its equations by calculating the zero dynamics of a constrained system. In Section 3, we show that the system is feedback equivalent to the normal form. Section 4 presents results considering flatness of 2D and 3D crane systems. Finally, in Section 5 we use the fact that for a control system to be flat is equivalent to be dynamically linearizable, to derive a control law for the trajectory tracking problem and show, in Section 6, simulation results for the 2-crane and 3-crane systems. We stress that the presented dynamic linearization is exact, in the sense that the nonlinearities of the system are fully compensated by a change of coordinates and feedback and should not be confused with the linear approximation, where nonlinearities are neglected.

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