

Predictive Functional Control with Disturbance Observer for Tendon-Driven Balloon Actuator

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Abstract : In recent years, Japanese society has been aging, engendering a labour shortage of young workers. Robots are therefore expected to perform tasks such as rehabilitation, nursing elderly people, and day-to-day work support for elderly people. The pneumatic balloon actuator is a rubber artificial muscle developed for use in a robot hand in such environments. This actuator has a long stroke, and a high power-to-weight ratio compared with the present pneumatic artificial muscle. Moreover, the dynamic characteristics of this actuator resemble those of human muscle. This study evaluated characteristics of force control of balloon actuator using a predictive functional control (PFC) system with disturbance observer. The predictive functional control is a model-based predictive control (MPC) scheme that predicts the future outputs of the actual plants over the prediction horizon and computes the control effort over the control horizon at every sampling instance. For this study, a 1-link finger system using a pneumatic balloon actuator is developed. Then experiments of PFC control with disturbance observer are performed. These experiments demonstrate the feasibility of its control of a pneumatic balloon actuator for a robot hand.

Keywords : disturbance observer, pneumatic balloon, predictive functional control, rubber artificial muscle

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