Stable optimal self-tuning interval type-2 fuzzy controller for servo position control system

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Abstract: An optimal self-tuning interval type-2 fuzzy controller for servo position control systems is reported here. To achieve precise positioning of the actuator, input scaling factors of an interval type-2 fuzzy proportional-integral controller are updated online depending on the latest operating conditions in terms of closed loop tracking error and change of error. To ensure desired performance, input scaling factors are obtained by adaptive cuckoo search-based optimisation algorithm. Efficacy of the proposed scheme is substantiated through performance comparison with recently reported peak observer based and online self-tuning based interval type-2 fuzzy PID, interval type-2 fuzzy PI, and also type-1 fuzzy PI controllers through simulation study along with real-time validation on a DC servo position control system. Lyapunov function-based stability analysis for the proposed controller is also provided.

Keywords: type-2 fuzzy control; self-tuning mechanism; optimal fuzzy control; servo position control; real-time experimentation.

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