A Nuclear Reactor Power Controller Using a Receding Horizon Control Method

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Abstract

A receding horizon control method is applied to design a fully automatic controller for thermal power in a reactor core. The basic concept of the receding horizon control is to solve an optimization problem for a finite future at current time and to implement as the current control input the first optimal control input among the solutions of the finite time steps. The procedure is then repeated at each subsequent instant. The receding horizon controller is designed so that the difference between the output and the desired output is minimized and the variation of the control rod position is small. The nonlinear PWR plant model (nonlinear point kinetics equation with six delayed neutron groups and the lumped thermal-hydraulic balance equations) was used to verify the proposed controller of reactor power. And a controller design model used for designing the receding horizon controller was obtained by applying a parameter estimation algorithm. From numerical simulation results, the performances of this controller for the 5%/min ramp increase or decrease of a desired load and its 10% step increase or decrease which are design requirements are proved to be excellent.