

Fuzzy and Fuzzy-PI Controller for Rotor Speed of Gas Turbine

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Abstract : Speed control of rotor during startup and under varying load conditions is one of the most difficult tasks of gas turbine operation. In this paper, power plant gas turbine (GE9001E) is considered for this purpose and fuzzy and fuzzy-PI rotor speed controllers are designed. The goal of the presented controllers is to keep the turbine rotor speed within predefined limits during startup condition as well as during operating condition. The fuzzy controller and fuzzy-PI controller are designed using Takagi-Sugeno method and Mamdani method, respectively. In applying the fuzzy-PI control to a gas-turbine plant, the tuning parameters (Kp and Ki) are modified online by fuzzy logic approach. Error and rate of change of error are inputs and change in fuel flow is output for both the controllers. Hence, rotor speed of gas turbine is controlled by modifying the fuel flow. The identified linear ARX model of gas turbine is considered while designing the controllers. For simulations, demand power is taken as disturbance input. It is assumed that inlet guide vane (IGV) position is fixed. In addition, the constraint on the fuel flow is taken into account. The performance of the presented controllers is compared with each other as well as with H^∞ robust and MPC controllers for the same operating conditions in simulations.

Keywords : gas turbine, fuzzy controller, fuzzy PI controller, power plant

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