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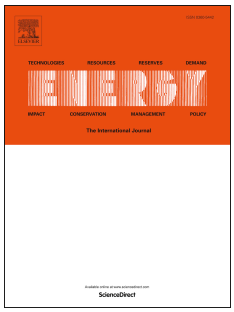

A robust heat recovery steam generator drum level control for wide range operation flexibility considering renewable energy integration

P.U. Sunil, Jayesh Barve, P.S.V. Nataraj

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A Robust Heat Recovery Steam Generator Drum Level Control for Wide Range Operation Flexibility Considering Renewable Energy Integration

Sunil P U*, Jayesh Barve, P.S.V. Nataraj*****

**GE Power and Water, HTC, Hyderabad, India (e-mail: sunil.unnikrishnan@ge.com;sunil@sc.iitb.ac.in).*
***GE Global Research Centre, Bangalore, India (jayeshkumar.barve@ge.com)*
**** Systems and Control Engineering Dept, Indian Institute of Technology Bombay, Mumbai, India, (e-mail: nataraj@sc.iitb.ac.in)*

Abstract: This paper focuses on improving the performance of boiler drum level control over a wide range of operation envelopes for the smooth integration of renewable energy. The Quantitative Feedback Theory (QFT) approach is used to design robust control systems for improving the boiler drum level dynamics over a wide operating range. A case study is performed on a heat recovery steam generator (HRSG) type boiler from a combined cycle power plant (CCPP). The wide range of HRSG operation is enveloped between hot and cold start-up profiles of the CCCP. The nonlinear dynamics of boiler drum level over this operation envelop is modelled in terms of linear models with parametric variations. A robust three-element QFT control system is then proposed, designed, and validated on the nonlinear model via simulations. The proposed robust control system is compared for its performance with the existing conventional three-element control scheme. Comparative analysis of the control results show that the proposed robust control gives much superior performance over the existing conventional control – the proposed robust control reduces the control errors by as much as 77% with similar control effort. Thus, the proposed robust control seems to be highly promising in *real-world* boiler drum level control applications.

Keywords: Boiler Drum Level Control, Combined Cycle Power Plant, Drum type Boilers, Heat Recovery Steam generators, Quantitative Feedback Theory, Robust Control.