ON THE DESIGN AND EVALUATION OF HIERARCHICAL AND DECENTRALISED REGULATORS FOR AUTOMATIC GENERATION CONTROL

By
RAMINENI GOVAR DHANA RAO
Electrical Engineering Department

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CERTIFICATE

This is to certify that the thesis entitled," On the Design and Evaluation of Hierarchical and Decentralised Regulators for Automatic Generation Control" being submitted by R.Govardhana Rao, for the award of the degree of Doctor of Philosophy to the Indian Institute of Technology, Delhi, is a record of bonafide research work he has carried out under my guidance and supervision. The results contained in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

S.I. Ahson
Assistant Professor
Department of Electrical Engineering
Indian Institute of Technology
New Delhi 110 016

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R. Govardhana Rao

R. GOVARDHANA RAO

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ABSTRACT

The thesis is concerned with the design and evaluation of hierarchically structured and decentralised regulators for automatic generation control (AGC). AGC regulators are designed using the continuous-time (linear and non-linear) formulation and their effectiveness is evaluated through extensive computer simulation. Some new algorithms for the design of hierarchically structured regulators are proposed and their superiority over conventional AGC regulator is demonstrated. A two-area Hydro-Thermal power system model has been considered for illustrating the results. The design of two-level regulators using Siljak's method is also included.

Two modified versions of the linear interaction-prediction method have been developed for the design of regulators for automatic generation control, which take into account the practical constraints such as zero steady-state errors and generation rate constraints. The possibility of implementing the resulting "proportional-plus-integral-feedback" type of control law is illustrated through computer simulation on a two-area Reheat-Thermal-Hydro power system model. The responses are compared with those obtained by classical controllers. A discrete version of the continuous (analog) hierarchical two-level regulator is developed. The discrete version takes care of the practical constraints through the "proportional-state-plus-summation output-feedback"

type of control law. The results are illustrated using a two-area Reheat-Thermal-Hydro power system model.

Since the AGC models used in this thesis contain many inaccessible state variables, a decentralised-observer for estimating the unmeasurable state variables is proposed. The design of decentralised full-order observers for the AGC problem is based on the concept of unknown-input observer design. The performance of the decentralised observer is evaluated through computer simulation. For completeness of the thesis, proper background material, reviews and suggestions for further work in this area are included.

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