ROBUST POWER SYSTEM STABILISER DESIGN BASED ON μ - SYNTHESIS

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1. Brief introduction

One of the most important problems arising from large scale power systems is the low frequency oscillation. Excitation control or Automatic Voltage Regulator (AVR) is well known as an effective means to improve the overall stability of the power system. Power System Stabilisers (PSS) are introduced in order to provide additional damping to enhance the stability and the performance of the electric generating system. The output of the PSS as supplementary control signal is applied to the machine voltage regulator terminal.

Conventional PSS have been widely used in power systems. Such PSS ensures optimal performance only at a nominal operating point and does not guarantee good performance over an entire range of the system operating conditions. Several techniques have been proposed for the design of more robust PSS structures.

To guarantee the desired performance, this paper describes the control design models of a PSS based on μ-synthesis, μ-analysis and H∞ control methods, which is returned when the system configuration changes.
The control law is presented in both frequency domain and the time domain

Key words: Robust control, H∞, μ analysis and synthesis, Power system Stabilizer, optimal control.

2. System description

The power system considered in this study is modelled as a synchronous generator connected to a constant voltage bus through a double transmission line. [1], [2], [3], [4].
Let the generator operating point is defined by

$\xi = [P \; Q \; x_e]$

With P, Q and Xe are respectively active power, Reactive power and Reactance of the line of the network
These operating points are associated with a set models (A_i, B_i, C_i, D_i, L_i). For these models, uncertainties may be defined and taken into account in the controller design stage.

3 PSS Design based on μ-Synthesis and D-K iteration

The PSS based on μ-synthesis design approach is evaluated in simulation on different conditions of work (change of point of working, profile of the line, variation of reference voltage, as well as the mechanical torque). The results are illustrated for the operating points defined by $\xi = [P \; Q \; X_e]$.
Using μ-synthesis, it is possible to find a controller that stabilizes the power systems with the appearance of the system uncertainty and also realize the robust performance.

4 Conclusion

The robustness of the controller has been evaluated with respect to model uncertainties of the power generator. A comparative study of the proposed PSS with a conventional PI controller has been conducted.
The results demonstrate the superiority of the μ-controller and that, in this case, robust performance can be achieve with no need for a very complicated controller structure, by modelling plant uncertainties according to the described LFT structure.

5 References

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