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# Self-Tuning Power System Stabilizer Based on Recursive Least Square Identification and Linear Quadratic Regulator

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**Abstract :** Available commercial applications of power system stabilizers assure optimal damping of synchronous generator’s oscillations only in a small part of operating range. Parameters of the power system stabilizer are usually tuned for the selected operating point. Extensive variations of the synchronous generator’s operation result in changed dynamic characteristics. This is the reason that the power system stabilizer tuned for the nominal operating point does not satisfy preferred damping in the overall operation area. The small-signal stability and the transient stability of the synchronous generators have represented an attractive problem for testing different concepts of the modern control theory. Of all the methods, the adaptive control has proved to be the most suitable for the design of the power system stabilizers. The adaptive control has been used in order to assure the optimal damping through the entire synchronous generator’s operating range. The use of the adaptive control is possible because the loading variations and consequently the variations of the synchronous generator’s dynamic characteristics are, in most cases, essentially slower than the adaptation mechanism. The paper shows the development and the application of the self-tuning power system stabilizer based on recursive least square identification method and linear quadratic regulator. Identification method is used to calculate the parameters of the Heffron-Phillips model of the synchronous generator. On the basis of the calculated parameters of the synchronous generator’s mathematical model, the synthesis of the linear quadratic regulator is carried-out. The identification and the synthesis are implemented on-line. In this way, the self-tuning power system stabilizer adapts to the different operating conditions. A purpose of this paper is to contribute to development of the more effective power system stabilizers, which would replace currently used linear stabilizers. The presented self-tuning power system stabilizer makes the tuning of the controller parameters easier and assures damping improvement in the complete operating range. The results of simulations and experiments show essential improvement of the synchronous generator’s damping and power system stability.

**Keywords :** adaptive control, linear quadratic regulator, power system stabilizer, recursive least square identification
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