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DESIGN OF A POWER SYSTEM STABILIZER USING A NEW RECURRENT NETWORK

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Abstract. *This paper presents a new two-layer recurrent neural network (RNN) for a power system stabilizer (PSS) design called the recurrent neural network power system stabilizer (RNNPSS). The RNNPSS consists of a recurrent neural network identifier (RNNI) that tracks and identifies the power generator and a recurrent neural network controller (RNNC) that supplies an adaptive signal to the governor and exciter to damp the power system oscillation. The RNN consists of an input layer and an output layer. Each neuron in the input layer is a recurrent neuron connected to itself, other neurons and the output layer. The proposed RNNPSS is simulated for a single machine generator. The simulation results demonstrate the effectiveness of the proposed RNNPSS and its' reduced sensitivity to system disturbances. The operating range was demonstrated as better than that for a conventional PSS.*
Keywords: System control, Recurrent neural network, Power system stabilizer, Identifier and controller, RNNPSS

1. **Introduction.** Power systems are complex nonlinear systems that often exhibit low-frequency oscillations due to dynamic loads and/or sudden power system transmission events. Because power systems are highly non-linear and dynamic, the PSS provides supplementary control signals to the excitation and governor systems of the generating unit to dampen these oscillations and improve the generator's dynamic performance [1-3]. In recent decades, conventional power system stabilizers (CPSS) such as the linear quadratic regulator (LQR) PSS, self-tuning PSS, variable structure PSS and adaptive PSS have been proposed to provide optimum damping to the system oscillations [4]. The LQR PSS and pole assignment with least distance summation criterion methods were proposed to solve the state feedback gain to obtain the optimal poles and good transient response. However, the operating range was limited because of a power system's dynamic oscillation. The optimal pole shifting method for improving the PSS oscillations control using an adaptive optimal pole assignment has also been used in recent years [5], and this exhibited better performance. But the CPSS still shows the following drawbacks: 1) the CPSS is based on a linear model, but the power system is not; 2) time consumed on tuning is longer; and 3) CPSS cannot provide the desired performance in terms of the entire operating range [6-8].