IJDACR
ISSN: 2319-4863

IJDACR
International Journal Of Digital Application & Contemporary Research

**International Journal of Digital Application & Contemporary Research**
**Website: www.ijdacr.com (Volume 13, Issue 10, May 2025)**

# Enhancing Power System Stability Integrating Neural Network Control & PSO Optimization for Single Machine Infinite Bus

Girase Sagar Mahendrasing
P. G. Student
Department of Electrical Engineering
(Electronics and Power)
LSSBM's Padm. Dr. V. B. Kolte College of Engineering, Malkapur, Dist. Buldhana, India
sagargirase45@gmail.com

Prof T. Y. Kharche
Department of Electrical Engineering
(Electronics and Power)
LSSBM's Padm. Dr. V. B. Kolte College of Engineering, Malkapur, Dist. Buldhana, India

*Abstract* – **This paper presents a hybrid control strategy combining Particle Swarm Optimization (PSO) with Neural Networks (NN) to enhance the stability of the Single Machine Infinite Bus (SMIB) system. Conventional Power System Stabilizers (PSS) are effective in suppressing electromechanical oscillations but struggle with the dynamic and non-linear complexities of modern power systems. The proposed PSO-NN controller automatically tunes the neural network parameters, leveraging the global search capabilities of PSO to optimize system stability under varying conditions. Simulation results demonstrate significant improvements in transient stability, reduced oscillations, and faster settling times, particularly in minimizing rotor angle error and speed overshoot. This approach offers a robust solution for modern interconnected grids, addressing increasing system complexities and disturbances. The study also suggests potential extensions, such as incorporating renewable energy sources and exploring additional optimization algorithms to further enhance grid resilience and stability.**

*Keywords* – **Artificial Intelligence (AI), Hybrid Control Strategy, Neural Networks (NN), Particle Swarm Optimization (PSO), Power System Stabilizer (PSS), Rotor Angle Stability, Single Machine Infinite Bus (SMIB), Transient Stability.**