

## NONLINEAR ROBUST CONTROLLER DESIGN FOR THYRISTOR CONTROLLED SERIES COMPENSATION

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**ABSTRACT.** *The problem of transient stability for a single machine infinite bus system with thyristor controlled series compensation (TCSC) is addressed in this paper. The system does not need to be linearized, and the damping coefficient is measured inaccurately. A nonlinear robust controller and a parameter updating law are obtained simultaneously based on modified adaptive backstepping sliding mode control and Lyapunov methods. The closed-loop error system is guaranteed to be asymptotically stable. The simulation results show that rapid speed response and strong robustness can be obtained by the proposed method than the conventional adaptive backstepping and adaptive backstepping sliding mode control methods. The proposed method can be also be applied to other nonlinear systems with lower-triangular structure.*

**Keywords:** Modified adaptive backstepping sliding mode, Nonlinear robust control, Thyristor controlled series compensation

**1. Introduction.** In recent years, voltage stability and voltage collapse phenomena have become more and more important issues in power system analysis and control. It is well known that as the electrical power transmission levels increase, the stability margins of the power system decrease. The design of an advanced control system to enhance the power system stability margin so as to achieve higher transfer limits is one of the major problems in power systems, and a great deal of research has been dedicated to it [1-3].

With the development of power electronics technology, flexible alternate current transmission system (FACTS) devices have been widely employed in power systems and provide very good controllability to improve global system dynamics. Thyristor controlled series compensation (TCSC) as one of the FACTS devices is an effective and economical means to enhance the transmission capability and improve the stability of long transmission systems. In the steady state, FACTS devices like TCSC help in controlling voltage stability and increasing the power flow through a line due to its reactive power compensation capacity. However, the other important aspect of these controlled devices is their use during large disturbances such as faults because of their capability to improve the transient