

**DAMPING ELECTROMECHANICAL OSCILLATIONS WITH SYNCHRONOUS
COMPENSATORS: A FUNDAMENTAL STUDY**

**PS1: Changing Role of Electrical Machines in Power Generation:
Variable speed/pump storage and synchronous compensator design and performance for
supporting power generation networks**

LUIS ROUCO, JORGE SUÁREZ, FIDEL FERNÁNDEZ-BERNAL
Instituto de Investigación Tecnológica (IIT)
ETS Ingeniería ICAI
Universidad Pontificia Comillas
SPAIN
rouco@comillas.edu

The increase of the penetration of inverter-based generation in current power systems is resulting in the reduction of their short circuit currents and inertia. Synchronous compensators are being proposed and installed to address those issues [1].

Power system electromechanical oscillations are also of great concern in many power systems as power exchanges have increased due to the integration of power markets. Recent events in the Continental European system have shown that the security of the power system may be at risk due to poorly damped inter-area oscillations ([2], [3]).

Synchronous compensators have also been proposed to damp electromechanical oscillations [4]. The ability of synchronous compensators to damp electromechanical oscillations may be questioned since the electrical machine is not supplying active power.

This paper contains a fundamental study of the contribution of synchronous compensators to the damping of electromechanical oscillations based on eigenvalue analysis of the small-signal model of simple power system models. Fundamental studies have been proposed in the technical literature as investigation approaches before the industrial application of technology ([5], [6]).

Two power system models will be considered. The first power system model under consideration consists of a synchronous compensator connected to an infinite bus. In contrast, the second one comprises a synchronous generator and a synchronous compensator running in parallel connected to both to an infinite bus through a transmission system.

The eigenvalue analysis, using participation factors and residues ([7]-[9]), of the first power system will show that the electromechanical oscillation of the synchronous compensator cannot be affected by a power system stabilizer (PSS). The eigenvalue analysis of the second power system will confirm that although the joint electromechanical oscillation of both synchronous machines against the infinite grid can be damped by installing a PSS in the synchronous compensator, the most effective location of the PSS is the synchronous generator.

Keywords

Synchronous compensators, electromechanical oscillations, power system stabilizers

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