

# Electromechanical Oscillation Damping in one Hydraulic Central

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**Abstract:** Studies, simulations, and tests carried out to damp electromechanical oscillations are described. The solution was to install Power System Stabilizer (PSS) in 4 generator of 118 MW each one, located in one hydraulic plant. This plant is connected to "Sistema Eléctrico Patagónico Interconectado (SEPI)" through a double 330 kV transmission line, with its far end connected to one aluminum plant with two 160 MW series of 200 electrolytic cells each one. Studies began with whole system data base validation, included the aluminum plant dynamic load model. Modal analysis and temporal simulation of event that excite dominant electromechanical oscillation mode were done. PSS tuning parameters were found, and the reciprocal influences between PSS and turbine governor were minimized. PSS commissioning test were carried out, and the results are compared with previous studies, showing a good agreement.

**Keywords:** Load modeling. Power System Stabilizer. Excitation Control. Turbine Governor. Power System Dynamic Stability.

## I. INTRODUCTION

The SEPI is an electrical system relatively small, their peak load is of approximately 600 MW, has a hydraulic power plant with four units of 118 MW each one, that connects through one double line of 330 kV and 550 km, with an aluminum plant. The rest of the system has 1300 km in 132 kV lines, with distributed load and generation, in radial configuration, being an important part of this demand constituted by motors in petroleum deposits.

The aluminum plant is constituted by two electrolytic series of 200 cells each one, and has gas turbine electric generation.

In Fig. 1 is indicated a simplified scheme of SEPI, showing the present situation of the aluminum plant and its future enlargement. The values of demand of the electrolytic series, and the installed generator powers in the aluminum plant and the hydraulic power plant have been indicated.

There was a restriction to the power transmission on the double line of 330 kV, because the operation experience and previous studies indicate the presence of an electromechanical oscillation with not acceptable damping.

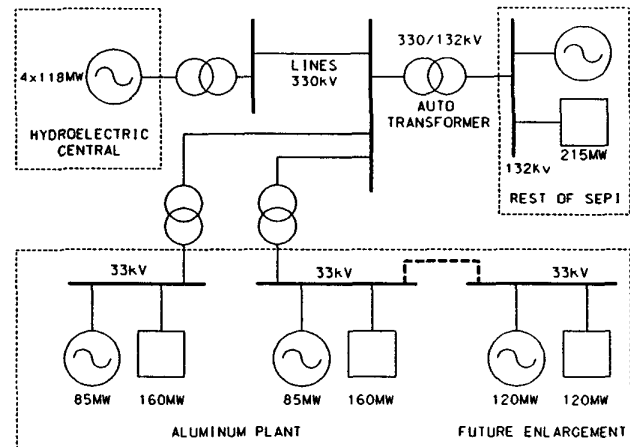


Fig. 1: SEPI simplified scheme.

By such a reason, the power hydraulic plant agent commissioned the necessary studies. These studies began with the conformation of a Database for dynamic studies, validated with data contributed by manufacturer and tests made previously.

A particular interest was put to find a load model that represents suitably the aluminum plant, specially in the frequency range of the electromechanical oscillations.

Also, the model of the excitation control system of the hydraulic machines was verified by tests.

Then different study scenarios were considered those include present situations and future enlargements of the SEPI, as much in lines, as in installation of new generators and new demands. As the power hydraulic power plant is located in a SEPI far end and is the greatest generator in this system, all the possible participation cases in the system dispatch were analyzed, with the lowest and highest possible hydraulic head.

The PSS effectiveness was analyzed, with PSS working with electrical power or accelerating power signals. The reduction of the PSS negative impact over the turbine governor was evaluated, selecting the most appropriate adjustment. Finally, tests were made in the PSS commission, to verify their correct performance.

## II. DATABASE

All the necessary models for the studies were determined previously, from manufacturer information, or tests made in the past, or specific tests made to such aim.

In those cases when there were not test information, the recommended model and typical adjustments were taken, between many others: from [1] for the excitation controls; from [2] for turbine governors, and from [3] for the machine

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