IDENTIFICATION OF PARTIALLY KNOWN MODELS OF THE SUSQUEDA HYDROELECTRIC POWER PLANT

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***Abstract*— This paper presents the identification of a hydroelectric power turbine dynamics. Knowledge of power plant behaviour is fundamental to obtain reliable and efficient operation of power systems. Starting from models already proposed, some modifications are suggested in order to adjust real plant response, recorded from different conditions and situations, to model behaviour.**

***Keywords*— Identification, Hydroelectric Power Plant, Models.**

I. INTRODUCTION

The AGC (Automatic Generation Control) performance of power systems is strongly influenced by the dynamic characteristics of its power plants. It is therefore of certain importance to have accurate models of the plants that contribute significantly to the AGC. There are in the literature some well-established structures for those models, but it is necessary, in each particular case, to identify the model parameters. In this paper the identification of a hydroelectric power turbine dynamic model has been performed for the Susqueda power plant, which is a hydroelectric plant belonging to the Endesa Group in Spain. Models taken as an initial step are described, although some modifications have been carried out in order to adjust the response of the real plant to model behaviour. The identification approach makes use a group of models with complex hydraulic dynamics, since all of them are nonlinear, and the models consider surge tank effects.

Dynamic behaviour of the power plant has been recorded in different conditions and situations, and consists of the gate opening and the measured electric power, which may be considered as the measured mechanical power generated by the turbine.

The identification has used registers that correspond to normal work conditions and they have been chosen for having the most complete frequency spectrum, hence they guarantee appropriate identification results.

This paper is organised as follows: Section II describes the physical characteristics of the power station. Section III presents the dynamic equations considering a general nonlinear model with surge tank effects, and proposes some adjustments of the model. Section IV shows the adjustment of the equations. Section V presents the results of the simulation using alternative models. Section VI describes a comparative study of the behaviour of the models. Finally, Section VII summarises the conclusions of this paper.

II. CHARACTERISTICS OF THE HYDROELECTRIC POWER PLANT

The Susqueda power station is situated next to Susqueda's reservoir in the province of Girona (Spain), which is supplied by the river Ter. The total installed power is 86 MW with three units (2 x 37 MW + 1 x 12 MW) and with an annual production of 180 GWh.

This work deals with one of the 37 MW units of the power station. Figure 1 presents a diagram of the main elements of the Susqueda power plant No 2 and shows the heads and flows that intervene in a hydroelectric plant model that considers surge tank effects.

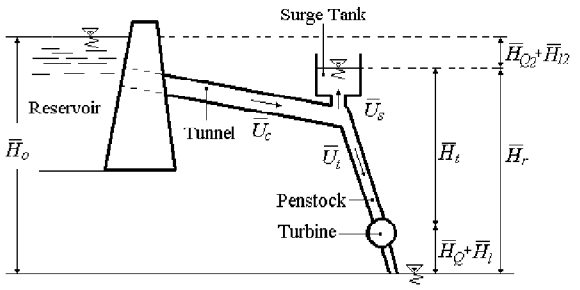

Fig. 1. Graphic of the hydroelectric power plant.

The hydroelectric power plant No 2 of Susqueda has the following characteristics (Tables 1 and 2):

Table 1: Plant Characteristics.

The Plant	
Total Head (H_{base})	174.41 m
Head Losses (H_l+H_{l2})	10.39 m
Maximum Flow (Q_{max})	65 m^3/seg
Installed Power	37 MW