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Account of additional factors for damping torsional oscillations

Basim Talib Kadhem [a,**], Hamed W. Shuhati [a], Bilal Naji Alhasnawi [b], Vladimír Bureš [c,*]

[a] Electrical Engineering Department, University of Basrah, Basrah, Iraq
[b] Department of Electricity Techniques, Al-Samawah Technical Institute, Al-Furat Al-Awsat Technical University, Kufa, Iraq
[c] Faculty of Informatics and Management, University of Hradec Králové, 50003, Hradec Králové, Czech Republic

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A B S T R A C T

Some parameters are influenced by the turbine unit's torsional oscillations. The fundamental comes from damping these oscillations, which are brought on by a departure in the turbine blades' speed from the device's prediction of the steam volume, and attenuation of fluctuations due to the distribution of energy in the turbine's productive components. The usual single-machine infinite bus system is used for the analysis. For various turbine-generator shafts and various generator operating situations, rotating mass mechanical system evaluations for small-signal stability and large disturbance are conducted. It is demonstrated that the shaft's "structural' damping (H) and "steam' damping (Kn) coefficients have a considerable impact on the damping of torsional modes. The goal of this work is to determine the effect of changing the damping factors in the mathematical model of the steam turbine shaft on the system's static stability, as well as the extent to which these variables' limits on damping rotational oscillations on the maximum torsional torques generated in the shaft masses. The mathematical model of the steam turbine shaft with a single machine and transmission line to an infinite bus system was simulated using Dymola software, and the static and dynamic effects of damping factors (H) and (Kn) on system stability were demonstrated. By evaluating the best case for parameters with the least influence on the system's stability, the results were obtained by changing the factors (Kn) from 0.005 to 0.5 and (H) from 0.005 to 0.2 and the extent of its effect on the maximum torque of the steam turbine masses and reducing it by 8.4 %, as well as by reducing the settling time of the system after disturbances occur and reaching to Steady state by about 90 %.

1. Introduction

The rotating multi-mass shaft system's torsional oscillation has drawn a lot of interest. Numerous studies have been conducted since the first two reported shaft failures in the Mohave Power Station (USA) in 1970 and 1971 [1] due to torsional oscillations, to explain the phenomenon and to suggest preventive measures to stop shaft brake-downs and other related issues in the future. Due to electric network faults, planned and unforeseen switching accidents, and resonance with series compensated transmission lines, the shaft segments of turbine-generator units are subject to large amplitude, oscillatory, and mechanical stresses [2–4]. According to

* Corresponding author.
** Corresponding author.
E-mail addresses: basim.kadhem@uobasrah.edu.iq (B.T. Kadhem), hamed.shuhati@uobasrah.edu.iq (H.W. Shuhati), bilalnaji11@yahoo.com (B.N. Alhasnawi), vladimir.bures@uhk.cz (V. Bureš).

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