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Analysis of Co-Ordinated Design of PSS and SSSC Based Damping Controller Considering Transmission Delay

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Abstract—**This paper exhibited an effective methodology for planning an organized PSS and a SSSC based advantageous damping regulator. The planned methodology is used for damping low frequency motions in a SMIB power system considering the different framework transmission time delays. PSS are utilized in system to decrease the low frequency oscillation however utilization of PSS is inadequate in some situations. Thus, the plan issue related with the planned regulator is considered to as an optimization issue. The heuristic calculations like GA, PSO and GSA are utilized to find the organized design boundaries. The proposed work essentially analyzes the three calculations.**

Keywords - Damping controller; flexible AC transmission systems; genetic algorithm (GA); gravitational search algorithm; particle swarm optimization (PSO);power system stabilizer (PSS).

I. Introduction

The PSSs are all around utilized in the power industry to wash out the low frequency oscillation [1]. Notwithstanding, in some strange circumstances, the utilization of PSS is lacking to give adequate damping. This is chiefly when the system is upset by some strange abnormal conditions. Hence, different choices are extremely fundamental to keep away from such system possibility [2]. During the last decade, FACTS goes about as a promising idea for power system applications. The SSSC is viewed as perhaps the most flexible gadgets in the FACTS family. The fundamental capacity of SSSC the transmission line, reduce system wavering and offer voltage support.

A damping regulator is by and large utilized in the system for strength examines. The boundary tuning for a damping regulator is consistently a troublesome process [4]. The presentation of a system can be improved by planning a PSS and a FACTS-based damping regulator which can be worked in a coordinated way [5]. The different soft computing methods or Evolutionary processing have been applied to discover these boundaries [6]. GA is an individual from delicate figuring methods, which chips away at Darwin's hypothesis of advancement " survival of the fittest " [7]. Once more, to take care of the complex advancement issue, the PSO strategy is utilized [8]. The PSO calculation is motivated by the capacity of the groups of birds. The PSO calculation consistently attempts to further develop the candidate solution, subsequently can tackle or upgrade a complex optimization problem [9]. As of late, the advancement of the GSA calculation gives a powerful device that can deal with complex issues. In scholarly world and the business reason, GSA has been mainstream [10-11].

II. Modeling the Power System with SSSC

An SMIB power system is shown in Fig. 1 alongside an SSSC. The SSSC utilizes the idea of VSC and is generally associated with the line through a transformer and powerfully the degree of remuneration of the SSSC. Consequently, the damping regulator is utilized with the SSSC to shape an organized design, which can further develop the system damping accordingly further develops dynamic security [1].

A. Modelling of Generator:-

The expression of the system equation is given by [2]:

$$V_d = R_s i_d + \frac{d}{dt}\phi_q - \omega_R \phi_q \qquad (1)$$

$$V_q = R_s i_q + \frac{d}{dt}\phi_q + \omega_R \phi_d \qquad (2)$$

$$V'_{fd} = R'_{fd} i'_{fd} + \frac{d}{dt}\phi'_{fd} \qquad (3)$$

$$V'_{kd} = R'_{kd} i'_{kd} + \frac{d}{dt}\phi'_{kd} \qquad (4)$$

$$V'_{kq1} = R'_{kq1} i'_{kq1} + \frac{d}{dt}\phi'_{kq1} \qquad (5)$$

$$V'_{kq2} = R'_{kq2} i'_{kq2} + \frac{d}{dt}\phi'_{kq2} \qquad (6)$$

Where:

$$\phi_d = L_d i_d + L_{md}\left(i_{fd} + i_{kd}\right),\ \phi_q = L_q i_q + L_{mq} + i'_{kq},$$
$$\phi'_{fd} = L'_{fd} i'_{fd} + L_{md}\left(i_d + i'_{kd}\right), \phi'_{kd} = L'_{kd} i'_{kd} + L_{md}\left(i_d + i'_{fd}\right),$$
$$\phi'_{kq1} = L'_{kq1} i'_{kq1} + L_{mq} i_q \phi'_{kq2} = L'_{kq2} i'_{kq2} + L_{mq} i_q$$

Where d & q shows d and q-axis quantities.