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Robust PID Optimized Load-Frequency Controller of a Two-Area Power System Considering Systems Uncertainties

Maryam Ashouri
Department of electronic, Tabriz Branch
Islamic Azad University
Tabriz, Iran
maryam68ashoory@gmail.com

Abstract— **The Load Frequency Control (LFC) has been a major subject in electric power system and is becoming more significant system in recent decades. This paper targets to investigate the problem of LFC in interconnected power systems in order to obtain robust state. In this paper, a design method for a robust controller, based on PID, has been presented to overcome the robustness against uncertainties. To achieve optimal PID, Particle Swarm Optimization (PSO) has been employed to obtain coefficients of the SMC. Variations of uncertain parameters are considered between -40% and +40% of nominal values. The simulation results show that the system response with the proposed PID is better than the conventional PID controller. It is also shown that the transient response of the tie line power can be improved.**

Keywords: Load Frequency Control, PID Controller, PSO algorithm

I. INTRODUCTION

Load-Frequency Control (LFC) is one of the problems in electric power system, because the loading in a power system forced to changes [1]. This change has affected in the frequency change in power systems. Moreover, it is obvious that the operation objectives of the LFC are to preserve uniform frequency for separating the load between generators and controlling the tie-line interchange schedules [2]. There are errors in the quantities due to unforeseen load variations which cause maladjustment between the generator and load demand. One of the tasks of Automatic Generating Control (AGC) is to improve the transient state and to warrant zero steady state errors of these two variables. Therefore, LFC is employed to preserve the system frequency and the tie-line power near to the scheduled values [3].

For large scale electric power systems are usually composed of interconnected subsystems. The connection between the subsystem or control areas (tie-line) is important to maintain system frequency [4]. Also, each area has its own generator and it is responsible for its own load and scheduled exchange with neighboring areas. In a power system, each area contains different uncertainties and different kinds of disturbances due to increased complexity, system modeling errors and changing power system structure [5].

A well-designed electric power system must trade with changes in the load and with system disturbances or uncertainties, and it should prepare appropriate high level of power quality while maintaining both voltage and frequency within tolerable limits [4-6].

During the last three-decade, various control strategies for LFC have been proposed to improve frequency change in each areas and tie-line. A control theory has been proposed in [7] and used since the early 1970s. Proportional Integral (PI)