Department of Electrical Engineering

Delhi Technological University

(Formerly Delhi College of Engineering)

CERTIFICATE

This is to certify that the project entitled, **"**CSTR Control Using Model reference adaptive control and Bio-Inspired Optimization technique**"**,submitted by **Ms. Neha Khanduja**,University Roll No.14/C&I/2010, student of Master of Technology (Control and Instrumentation) in Electrical Engineering department from Delhi Technological University (Formerly Delhi college of Engineering), is a dissertation work carried out by her under my guidance during session 2012-13 towards the partial fulfillment of the requirements for the award of the degree of Master of Technology in Control & Instrumentation.

I wish her all the best in her endeavors.

Date: July 2013

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ABSTRACT

Now a day the control of chemical process is important craft in the industry. Mostly all the chemical process are highly nonlinear in nature this cause instability of the process The aim of this thesis is to design a concentration and temperature controller for a CSTR by adaptive control, selection of PID parameters using particle swarm optimization(PSO).

In the design of adaptive control, Model reference adaptive control (MRAC) scheme is used, in which the adaptation law have been developed both by MIT & Lyapunov's rule. Numerical calculation is used for steady-state analysis and dynamic analysis which is usually represented by a set of differential equations. A Simulation is carried out using Matlab.

PSO Algorithms come under the category of bio-inspired optimization techniques. The mathematical model of a CSTR motor is considered as a second order system for concentration and temperature control. Here, is a comparison between model reference adaptive control methods and optimization techniques of tuning of PID controller parameters. In some cases, it was found that the proposed PID parameters adjusted by optimization technique is better than the conventional techniques like a Ziegler-Nichols' method. These proposed optimization methods could be applied for higher order system also to provide better system performance with minimum errors. It is decided to create an objective function which will evaluate the optimum PID gains based on the controlled systems and overall error. This tries to explore the potential of using optimization techniques in controllers and their advantages over conventional methods. PID controller is the most widely used controller in the industry applications, need efficient methods to control the concentration and temperature of CSTR.

The conventional approach is not very efficient due to the presence of non-linearity in the system. The output of the conventional PID system has a quite high overshoot and settling time. In order to overcome the limitations of conventional PID controller PSO technique is used for tuning of PID controller to get an output with better dynamic and static performance. The application of PSO to the PID controller imparts it the ability of tuning itself automatically in an on-line process while the application of optimization algorithm to the PID controller makes it to give an optimum output by searching for the best set of solutions for the PID parameters.

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