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Implementation of Optimized PID Controllers in Real Time for Magnetic Levitation System



Soham Dey , Subrata Banerjee, and Jayati Dey

Abstract This paper aims to demonstrate a tuning method for the parameters of PID controller utilizing various modern meta-heuristic and swarm-intelligence-based optimization techniques for a laboratory scaled magnetic levitation system. Owing to the fact that classical controller tuning method failed to yield satisfactory result for a highly non-linear and unstable MAGLEV system; this work focuses on tuning of PID parameters employing a new artificial-intelligence-based optimization techniques, grey wolf optimization (GWO) and performance is compared with existing algorithms. The controller parameter optimization has been carried out by incorporating various error-based performance indices as objective functions. The proposed GWO-PID controller has proven its efficacy in terms of better transient specifications, optimum stability performance, accurate reference tracking capability, and improved convergence characteristic.

Keywords Evolutionary optimization · ITSE performance index · MAGLEV system · Optimized PID controller · Real-time implementation

1 Introduction

Magnetic levitation technique basically refers to a system, wherein a ferromagnetic object is levitated and suspended in the air with the help of electromagnetic forces without any visible means of mechanical or physical support [1]. Certain interesting features of MAGLEV system like: highly non-linear dynamic behavior, inherent instability, and free from mechanical frictional loss make this system suitable for application in many industrial applications. High speed MAGLEV trains [2], magnetically suspended wind turbines, magnetic bearings [3] are some of MAGLEV system's significant applications.

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