بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / مني مغربي أحمد

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

ملاحظات: لا يوجد

Cairo University

SATELLITE EARTH STATION POSITION CONTROL USING DIFFERENT OPTIMAL CONTROLLERS BASED ON EVOLUTIONARY OPTIMIZATION TECHNIQUES

By

Mohamed Elsayed Mohamed Saad Sakr

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electrical Power and Machines Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Title of Thesis:

Satellite Earth Station Position Control Using Different Optimal Controllers Based on Evolutionary Optimization Techniques

Key Words:
Satellite Earth Station ; Position Control ; Optimal Controllers ; Self-Tuning Controllers ; Evolutionary Optimization Techniques

Summary:
This work aims to present and discuss the satellite tracking control system based on DC servo motor. Particle Swarm Optimization (PSO), Adaptive Weighted Particle Swarm Optimization (AWPSO), Adaptive Acceleration Coefficients Particle Swarm Optimization (AACPSO), Modified Adaptive Accelerated Coefficients Particle Swarm Optimization (MAACPSO), Crazy Particle Swarm Optimization (C-PSO), Phasor Particle Swarm Optimization (PPSO),Gravitational Search Algorithm with Particle Swarm Optimization (GSA-PSO) and Eagle Strategy with Particle Swarm Optimization (ES-PSO) are proposed for optimal tuning of Proportional-Integral-Derivative (PID), Fuzzy PID (FPID), Variable Coefficient PID (V-PID), Fractional Order PID (FOPID) and Variable Coefficient Fractional Order PID (V-FOPID) controllers in satellite control system. Performance Index measured using Integral Based Objective Functions and Dynamic Performance Indices Based Objective Functions. Also, Self-Tuning Fuzzy PID (STF-PID) controller and Self-Tuning Fuzzy FOPID (STF-FOPID) are proposed for satellite tracking control system. MATLAB and SIMULINK were used to develop and simulate the system and control strategies. The response of the system is analyzed, the results of different control strategies are measured and compared with others.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Mohamed Elsayed Mohamed Sakr Date: / / 2022

Signature:

Dedication

This work is dedicated to my parents who demonstrated me the path to follow in life, also inspired me to appreciate the importance of education.

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First, Praise to Allah, Lord of the Worlds for the gift of good health and protection throughout the study period.

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Nomenclature

$ac_i^{(Iter)}$	: Acceleration of the agent (i) at iteration, ($Iter$)
a	: Power amplifier pole
B_m	: Motor viscous friction coefficient
B_L	: Load viscous friction coefficient
B_{eq}	: Equivalent viscous damping coefficient for both motor and load
$best^{(Iter)}$	: Personal best fitness during current population at iteration, $Iter$
C_1 , C_2	: Acceleration coefficients, usually are equal 2
C_{10} , C_{20}	: Initial values of acceleration coefficients
$C_1^{(Iter)}$, $C_2^{(Iter)}$	: Adaptive acceleration coefficients
C_1' , C_2'	: Weighting factors
$c_1, c_2, c_3, c_4,$ c_5 and c_6	: Gains of Variable Coefficient Controllers
de	: Rate change of error signal
E_b	: Back electromotive force
Ess	: Steady-state error
e	: Error signal
$F_m^{(Iter)}$	: The average value of the best position ($Pbest$) for all particles at current iteration ($Iter$)
$fitness_i^{(Iter)}$	: Fitness value of agent (i) at iteration, $Iter$.
$Gbest_i^{(Iter)}$	: Global best position in the swarm at iteration ($Iter$).
Go	: Gravitational constant.
$G^{(Iter)}$	: Initial Value of gravitational constant
I_a	: Motor armature current
$Iter$	: Iteration number
J_m	: Motor moment of inertia
J_L	: Load moment of inertia
J_{eq}	: Equivalent moment of inertia due to load and motor
J_1	: Single objective function
J_2	: Multi objective function