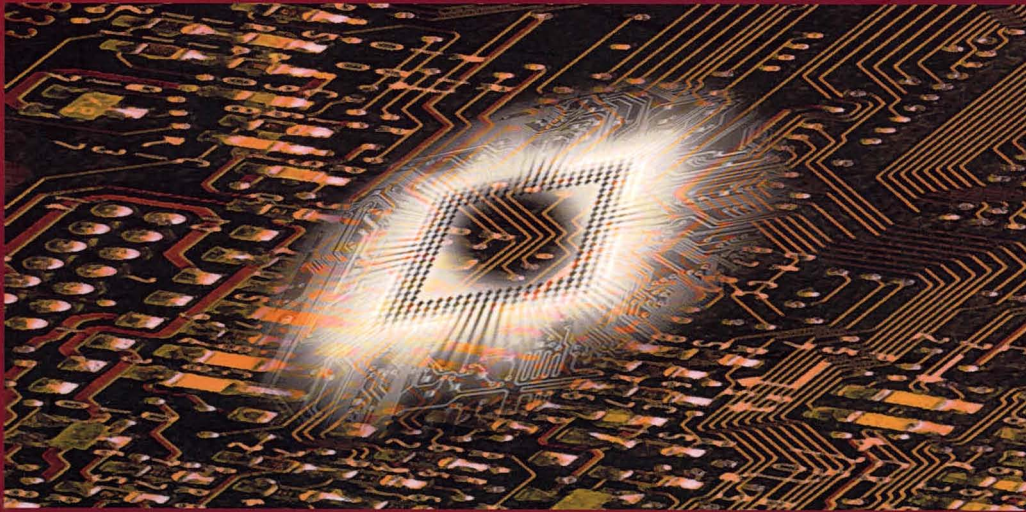


COMPUTATIONAL INTELLIGENCE IN ROBUST CONTROL

Theory and Applications



Rini Akmeliawati

Research Management Centre
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA



COMPUTATIONAL INTELLIGENCE IN ROBUST CONTROL

Theory and Applications

Editor: Rini Akmeliawati



IIUM Press

Published by:
IUM Press
International Islamic University Malaysia

First Edition, 2011
©IUM Press, IUM

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without any prior written permission of the publisher.

Perpustakaan Negara Malaysia

Cataloguing-in-Publication Data

Computational Intelligence in Robust Control: Theory and Applications
Bibliography p.
ISBN

ISBN: 978-967-418-196-3

Member of MajlisPenerbitanIlmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed by :
IUM PRINTING SDN. BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan.

TABLE OF CONTENTS

Preface	i
Acknowledgement	iii
Editor	iv
Table of Content	v
1. Computational Intelligence in Robust Control: A Review	1
R. Akmeliawati and S. M. Raafat	
2. Real-Coded Moga For Intelligent Control Of A Flexible Manoeuvring System	28
S. F. Toha and M. O. Tokhi	
3. Optimized LQR Controller Synthesis For 3DOF Helicopter Using Multi-Objective Differential Evolution (MODE)	57
I. B. Tijani, R. Akmeliawati, A. Legowo, A. G.A. Muthalif	
4. PSO-Based Robust Controller Design For A Rotary Inverted Pendulum Stabilization	89
M. I. Solihin, R. Akmeliawati, A. Legowo	
5. Design And Application Of Intelligent Fuzzy Controller On A Quarter Car Suspension System	113
Md. Mahbubur Rashid	
6. Intelligent Robust Control for Precise Tracking Performance of X-Y Positioning System	147
S. M. Raafat and R. Akmeliawati	

Chapter 1

COMPUTATIONAL INTELLIGENCE IN ROBUST CONTROL: A REVIEW

R. Akmeliawati, S. M. Raafat

Intelligent Mechatronics System Research Unit,
Department of Mechatronics, Faculty of Engineering,
International Islamic University Malaysia

This chapter provides a brief introduction to robust control design and computational intelligence (CI) approaches. The chapter focuses on three categories of CI, namely soft-computing, biological-inspired algorithm and multi objective techniques. A literature review on various techniques from each category as well as on intelligent robust control is presented. This chapter serves as an introduction to the topics covered by the rest of the book. As each topic discussed in this chapter is very vast on its own, more advanced and/or interested readers on the specific topic(s) can refer to references provided for further reading.

1.0 Robust Control Design

Robust control is a branch of control system design which explicitly deals with system uncertainties and performance under various disturbances, parameter variations and any other uncertainties, including noise. Robustness issue is the main concern in robust control design and addressed explicitly in the controller design. In control theory, a controller is designed to stabilize an unstable system and/or to achieve certain design specifications in the