PARAMETER ESTIMATION OF MULTIVARIABLE SYSTEM USING FUZZY STATE SPACE ALGORITHM

RESEARCH MANAGEMENT INSTITUTE
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR
MALAYSIA

ASSOC. PROF. DR. RAZIDAH ISMAIL
PROF. DR. TAHIR AHMAD
NOOR AINY HARISH
ROSENAH A. HALIM

APRIL 2011

Contents

1. Letter of Report Submission iii
2. Letter of Offer (Research Grant) iv
3. Acknowledgements viii
4. Enhanced Research Title and Objectives ix
5. Report 1
   - 5.1 Proposed Executive Summary 1
   - 5.2 Enhanced Executive Summary 2
   - 5.3 Introduction 3
   - 5.4 Brief Literature Review 5
   - 5.5 Methodology 8
   - 5.6 Results and Discussion 12
   - 5.7 Conclusion and Recommendation 19
   - 5.8 References 21
6. Research Outcomes 23
7. Appendices 25

3. Acknowledgements

In the Name of ALLAH s.w.t The Most Beneficient, The Most Merciful.

All praise is due only to ALLAH s.w.t, the Lord of the universe. Ultimately, only ALLAH s.w.t has given us the strength and courage to proceed with life in its entirety. His works are truly splendid and wholesome. His knowledge is truly complete with due perfection.

We would like to express our utmost gratitude to the Universiti Teknologi MARA (UiTM) and Ministry of Higher Education (MOHE) Malaysia for the financial support via Fundamental Research Grant Scheme.

We would also like to acknowledge with much appreciation the crucial role of the editors and reviewers for all our publications. Their valuable comments and suggestions throughout the preparation of various publications have helped us to improve our work.

Last but not least, deepest appreciation goes to our beloved parents, spouse and children for their prayers, inspiration and love.

May ALLAH s.w.t bless all of you.

4. Enhanced Research Title and Objectives

Original Title as Proposed:

Parameter Estimation of Multivariable System using
Fuzzy State Space Algorithm

Improved/Enhanced Title:

-NA-

Original Objectives as Proposed:

1. To formulate the Fuzzy State Space Model of a Superheater system.
2. To develop graphical user's interface so as to facilitate the implementation of Fuzzy State Space Algorithm for a Superheater system.
3. To develop a new approach in modeling and control of complex systems based on graph theory

Improved/Enhanced Objectives:

1. To formulate the Fuzzy State Space Model of a Superheater system.
2. To develop graphical user's interface so as to facilitate the implementation of Fuzzy State Space Algorithm for a Superheater system.
3. To develop a graphical Fuzzy State Space Model of a multi-connected system based on graph theory

5. Report

5.1 Proposed Executive Summary

Fuzzy State Space Model (FSSM) was developed to cope with the demand and performance due to the increase in the system complexity. The main feature of the model is the development of the Fuzzy State Space Algorithm (FSSA) for determination of input parameters that can be applied to any multivariable dynamic system. In this project, the FSSA is applied to the superheater system in the combined cycle power plant. The initial phase involved the development of the FSSM of the superheater system. In order to enhance the implementation of the algorithm, it is necesssary to develop an efficient computation program together with the user's interface. In the next phase, the transformation of FSSM to fuzzy graph is studied. The theory from directed graphs is explored to define and interpret the interconnections structure underlying the dynamics of the interacting systems. It is hoped that new concepts of dynamic connective stability of complex systems will be mathematically formalised. The proposed new approach is expected to provide a faster and innovative tool for simulation and analysis of multivariable system.