

TABLE OF CONTENTS

| | |
|--|-----------|
| آية..... | i |
| Dedication..... | ii |
| Acknowledgements | iii |
| Abstract..... | iv |
| خلاصة..... | v |
| Chapter One: Introduction..... | 1 |
| 1.1 Overview | 1 |
| 1.2 Research Objectives | 3 |
| 1.3 Research Layout..... | 3 |
| Chapter Two: Literature review | 4 |
| 2.1 Power equilibrium | 4 |
| 2.2 Power system stability | 4 |
| 2.2.1 Basic concepts | 4 |
| 2.2.2 Frequency stability | 6 |
| 2.3 Electric Power Systems Control | 8 |
| 2.3.1 Active power and frequency control | 9 |
| 2.3.1.1 Primary control..... | 10 |
| 2.3.1.2 Automatic generation control..... | 10 |
| 2.3.2 Interconnected power systems | 14 |
| Chapter Three: Mathematical model of the system | 15 |
| 3.1 Introduction | 15 |
| 3.2 Generator response to load change | 16 |
| 3.3 Load response to frequency deviation..... | 18 |

| | |
|--|-----------|
| 3.4 Prime-mover model | 20 |
| 3.5 Governor model..... | 21 |
| 3.6 Tie-line model | 26 |
| 3.7 Automatic generation control | 27 |
| Chapter Four: Fuzzy logic control. | 29 |
| 4.1 Introduction | 29 |
| 4.2 Structure of a fuzzy logic controller..... | 34 |
| 4.2.1 Fuzzification..... | 34 |
| 4.2.2 Fuzzy rule base | 35 |
| 4.2.3 Fuzzy inference | 35 |
| 4.2.4 Defuzzification | 37 |
| 4.3 Fuzzy logic controllers | 39 |
| 4.3.1 Fuzzy P Controller..... | 40 |
| 4.3.2 Fuzzy PD Controller | 41 |
| 4.3.3 Fuzzy PD+I Controller | 42 |
| Chapter Five: Computer simulation and results | 44 |
| 5.1 Introduction | 44 |
| 5.2 Single area power system | 45 |
| 5.2.1 System response without AGC | 45 |
| 5.2.2 AGC using conventional PID controller | 46 |
| 5.2.3 AGC using fuzzy PID controller..... | 48 |
| 5.3 Two area power systems..... | 51 |
| 5.3.1 System response without AGC | 51 |
| 5.3.2 AGC using conventional PID controller | 54 |
| 5.3.3 AGC using fuzzy PID controller..... | 57 |

| | |
|--|-----------|
| Chapter Six: Conclusions and recommendations..... | 64 |
| 6.1 Conclusions | 64 |
| 6.2 Recommendations | 66 |
| References | 67 |
| Appendix: Building fuzzy logic controller with MATLAB | 70 |