## INTENTS

| List of Abbreviations and Symbols | i |
| List of Figures                  | ii |
| List of Tables                   | iii |

### 1. INTRODUCTION  

1.1 Introduction  
1.2 Necessity  
1.3 Objectives  
1.4 Theme  
1.5 Methods  
1.6 Organization  

### 2. LITERATURE SURVEY  

2.1 Introduction  
2.2 Concern with Power Quality  
2.3 Power Quality Issues  
2.4 Meanings, Discussion & Elaboration  
2.5 Power Quality Aspects in Arc Plant  
  2.5.1 Harmonics and Inter Harmonics  
  2.5.2 Harmonic Distortion Limits – IEEE 519, 1992  
2.6 Furnace Operation Modes  
2.7 Electrode Position Control  
2.8 Quality of Regulation  
  2.8.1 The Arc Voltage and Power Distribution  
  2.8.2 Operating Reactance  
  2.8.3 Furnace Operation Strategy  
  2.8.4 The Arc Voltage and Power Distribution and the Influence on the Refractory Symmetry  
2.9 Circle Diagram
2.9.1 AC Supplied Electric Arc Furnace
2.9.2 Predetermination of Flicker
2.9.3 DC Supplied Electric Arc Furnaces
2.10 Arc Furnace Model Philosophy
   A) Time Domain Analysis Methods
   B) Frequency Domain Analysis Methods
   C) Power Balance Method

3. SYSTEM DEVELOPMENT
   3.1 Statement
   3.2 Methodology of System Development
   3.3 Power Quality Issue and Problem Formulation
   3.4 Modeling of Power System and Electric Arc Furnace
      3.4.1 Transmission Line Modeling
      3.4.2 Power Transformer Modeling
   3.5 Equivalent Circuit of AC Arc Furnace
      3.5.1 Single Phase Equivalent Circuit
      3.5.2 Three Phase Equivalent Circuit Diagram of an Arc Furnace
      3.5.3 Balanced Furnace Operation
      3.5.4 Effect of Reactance on Furnace
         a) Dead and Live Phases
         b) Lack of Sensitivity to Electrode Movement
         c) Interaction Effect
   3.6 Development of Arc Furnace Model
   3.7 Electrode Control System Model
      3.7.1 Electrode Position Control System
      3.7.2 Block Diagram of Electrode Control System
      3.7.3 Digital Control Strategy for Electrode Control
3.8 Static Var Compensator (SVC)  
   3.8.1 V-I Characteristics of an SVC  
   3.8.2 Static VAR Compensator Model  
   3.8.3 Controller Model  

4. PERFORMANCE ANALYSIS  
4.1 Harmonic Analysis  
4.2 Experimental Analysis  
   4.2.1 Harmonic Distortion  
   4.2.2 Measurement on 33 kV Side Section II, EAF-1 Bus  
   4.2.3 Harmonic Audit  
4.3 Computational Analysis of Furnace  
4.4 Comparison between Analysis and Computational Analysis for Arc  
   Furnace Harmonics  
4.5 Justification of Error of Arc Furnace for Harmonic Analysis  
4.6 Experimental Analysis of Harmonics in Rolling Mills  
4.7 Computational Analysis in Rolling Mills  
4.8 Comparison between Experimental Analysis and Computational Analysis  
4.9 Justification of Error of Rolling Mill  
4.10 Arc Furnace Performance Analysis  
4.11 Experimental Analysis of Arc Furnace Operation  
4.12 Statistical Analysis of Arc Furnace  
   4.12.1 Analysis from Circle Diagram  
   4.12.2 Effect of Electrode Regulation System on the Operating Point  
   4.12.3 Response to an Increase of Primary Voltage  
   4.12.4 Effect of Phase Rotation  
4.13 Computational Analysis of Arc Furnace  
4.14 Comparison of Experimental Analysis Statistical Analysis  
4.15 Justification of Error for Arc Furnace  
4.16 SVC Light Analysis  
4.17 Experimental and computational Analysis For Flicker Mitigation
4.17.1 Experimental Analysis of SVC Light Commissioned at Bhilai Steel Plant

4.18 Experimental Analysis and Computational Analysis of SVC Light Commissioned at Steel Plant

4.19 Comparison

4.18 Justification of Error

5. CONCLUSIONS

5.1 Conclusions

5.2 Future scope

5.3 Applications

REFERENCES

CONTRIBUTIONS

LIST OF PUBLICATION

APPENDICES

ACKNOWLEDGEMENT