**Design of a Modular, Direct-Drive Axial-flux PM Generator for Wind Turbine Applications**

**Chapter 1: Introduction**

* 1. Background of Wind Energy Harvesting
  2. Problem Statement and Research Objective
  3. Thesis Outline

**Chapter 2: Review of Wind Energy Conversion(WEC) Systems**

* 1. Power Equations and parameters
  2. Challenges in WEC Systems
  3. Current Wind Turbine Generator Systems
     1. Induction Generators
        1. Squirrel Cage Induction Generators (SCIG)
        2. Wound Rotor Induction Generators (WRIG)
        3. Doubly-fed Induction Generators (DFIG)
     2. Synchronous Generators

## Electrically Excited Synchronous Generators (EESG)

* + - 1. Permanent Magnet Synchronous Generators (PMSG)
  1. Flux orientations in PM based systems
     1. Radial Flux (RFPM)
     2. Axial Flux (AFPM)
     3. Transverse Flux (TFPM)
  2. Importance of modularity in WEC Systems and AFPM

* 1. Conclusion

**Chapter 3: Design of Proposed Generator**

* 1. Mechanical and Electrical parameters
     1. Fundamental Equations
     2. Geometrical paramaters
        1. Structural deflection
     3. Phase turns, Phase resistance & inductance and flux densities
        1. Thermal considerations
        2. Reluctances
        3. Flux and flux densities
     4. Volume and mass Equations
        1. Active mass calculation
        2. Structural mass calculation
     5. Losses
     6. Power and Efficiency
  2. Electromagnetic FEA vs Analytical evaluation for sample dimensions
  3. Conclusion

**Chapter 4:** **Optimization and Design**

-Introduction

-Evolutionary Algorithms(EA) and Genetic Algorithm(GA)

-Genetic algorithms based optimization

a)Constants

b)Objective Function

c)Constraints

d)Independent variables

-MATLAB GA Toolbox implementation

- 5 MW AFPM generator with optimized design parameters

**Chapter 5: FEA Verification**

-Introduction

-Design Considerations

a)Electromagnetic

b)Structural

c)Thermal

-Comparison of the optimization results with FEA results

**Chapter 6: Conclusions and Future Work**

-MW-level commercial counterparts of designed generator

-Conclusion

-Future work

**References...........**