King Saud University
College of Engineering
Electrical Engineering Department **Semester: 421**

Graduation Design Project Proposal Form

Project # P8

Project Title: **Design of Circuit for Low Voltage Winding Impulse Testing of Power Transformers**

Professor(s) Name(s): 1. **Dr. Yasin Khan**
2. **Dr. Abdulrehman Ali Al-Arainy**

Number of Students: Two

Students Qualifications:

The students should have basic knowledge of electrical power and having good academic background in High voltage/power systems

Statement of Problem

The electric utility industry's investment in power transformers has been rapidly rising due to many factors. Some of these factors are:

1. Refinement of manufacturer's design techniques.

2. Increases in power system fault duties due to decreased impedances of system components and increased size of generators in systems.

3. An increased awareness of savings for the utilities resulting from decreases in power transformer insulation levels.

All these factors necessitate accurate and sensitive transformer testing, since not only does a transformer failure represent a capital loss in itself, but also it affects adjacent equipment, generation downtime, transformer spare requirements, and several other factors. The technique of power transformer testing, known as Low Voltage Impulse Testing (LVI), was developed by Dr. Lech in Poland early in 1966. Even today, it is difficult to obtain the standard wave front/tail time (1.2/50μsec.) during testing of LV winding of high voltage and high power rating distribution transformers. The reason for this fact is that LV winding of large power transformer consists of few turns and posses large capacitance to ground. These few turns result in small inductance which is in parallel with large capacitance. Hence, this overall low impedance will always lead the impulse generator to a discharge possessing the short tail.

Brief Description of the Project

Keeping in view the above statement, a suitable method / circuit will be designed to get the desired lightning impulse voltage wave shape on the low voltage side of the distribution transformer testing.

Objectives

The project have the following objectives:

(1) Comprehensive literature review
(2) Design/acquisition of components required for development of prototype system
(3) Development of prototype system and its testing

Technical Approach and Expected Deliverables

The students should understand the main types of the distribution transformers, working principles, insulating materials used as insulation in the MV/HV windings in transformers, factors affecting the efficiency of insulating materials, causes and effects, measuring the output characteristics on the LV winding of the DT in the laboratory, data acquisition and analysis.

Project # P9

Project Title: Intelligent fuzzy control design for an ultra-precise positioning system

Professor(s) Name(s):
1. Dr. Irfan Ahmad
2. Dr. Yasser Bin Salamah

Number of Students: Two

Students Qualifications:
Background in analysis and design methods of a control system (course: EE351 automatic control). Interested students must be comfortable in working with MATLAB / Simulink.

Problem Statement and Brief Description of the Project

A very common positioning system comprises of a piezoelectric actuator for the precise movement and a capacitive position sensor to know the actual position. This kind of positioning system is used in various applications like in the fabrication of semiconductor ICs, manipulation of biological process like DNA analysis, manufacturing of small objects, optical alignment systems etc. In all these and many other applications, ultra-precise positioning is desired but to achieve high precision with fast positioning speed is still a great challenge.

The idea of this project is to design a fuzzy logic based controller to investigate the performance of a positioning system. Fuzzy logic has been successfully used in numerous fields such as power engineering, control systems engineering, image processing, industrial automation, robotics and consumer electronics etc. In this project, fuzzy controller and fuzzy based self-tuning PID controller will be thoroughly analyzed for the considered positioning system.

Objectives

Following tasks will be performed during this project:

(1) Conduct a literature review and formulate the problem.
(2) System dynamic modeling.
(3) Understanding of fuzzy controller.
(4) Design of an intelligent fuzzy controller.
(5) Design of an intelligent fuzzy based self-tuning PID controller.
(6) Development of simulation software and performance comparison with different controllers.

Technical Approach and Expected Deliverables

Complete analysis will be performed in MATLAB / Simulink software. Simulation software with detailed analysis is expected to be delivered at the end of this project. If possible, real-time experiments can also be performed in control lab.

Project # P10

Project Title: Modeling and control design for a wind turbine

Professor(s) Name(s):
1. Dr. Irfan Ahmad
2. Dr. Mubashir Alam

Number of Students: Two

Students Qualifications:
Background in analysis and design methods of a control system (course: EE351 automatic control). Interested students must be comfortable in working with MATLAB / Simulink.

Problem Statement and Brief Description of the Project

A wind turbine comprises of different sub-systems such as servomotor, drive train, generator and also the aerodynamic subsystem which converts the wind energy into useful mechanical energy. The optimum power from the wind turbine can not be achieved if the pitch angle of the turbine's blades are not properly controlled through servomotor under different changing environmental conditions like wind direction, wind gusts, storms, lack of the wind etc.

The idea of this project is to analyze the performance of a wind turbine with different control algorithms under different changing environmental conditions. An important step before the controller design is to achieve a mathematical model of a wind turbine. As wind turbine comprises of different sub-systems, writing mathematical equations describing the dynamic behavior of a wind turbine is little complex. We will try to achieve a simplified mathematical model first in this project. Based on this simplified mathematical model, different control algorithms will be designed and the performance of the wind turbine will be thoroughly analyzed.

Objectives

Following tasks will be performed during this project:

(1) Conduct a literature review and formulate the problem.
(2) System dynamic modeling.
(3) Controller design in order to achieve the desired performance.
(4) Development of simulation software.
(5) Performance comparison with different controllers and with different types of external disturbances.

Technical Approach and Expected Deliverables

Complete analysis will be performed in MATLAB / Simulink software. Simulation software with detailed analysis is expected to be delivered at the end of this project.

Project # P11

Project Title: Design of Protective Measures to Minimize the Effects of Large Fluctuations of PV Output Power on Stability of Nearby Synchronous Generators..

Professor(s) Name(s): 1. Saad Alghuwainem

Number of Students: 2

Students Qualifications

Matlab/Simulink

Statement of Problem

Large fluctuations of PV output power as in the case of a cloud passing over PV panels may cause loss of Stability of nearby synchronous generators. This is due to fast and large fluctuations in power due to lack of inertia (damping) of PV output.

Brief Description of the Project

Students will use Matlab/Simulink to model a simple system consisting of PV and synchronous generator connected to an infinite bus, supplying a common load. During the loss of generation from PV (due to clouds) , the synchronous generator will be overloaded for a short period. The problem is aggravated if the PV power suddenly comes back (clouds disappring) which may result in loss of synchronism of the synchronous generator

Objectives

Often, the design has two to four specific objectives. You might consider listing them vertically as follows:

(1) Minimize the impact of fast, and large PV power fluctuations.
(2) Maintain synchronous generator stability during large PV power fluctuations.
(3) Minimize cost of the design.

In this section, you would discuss more fully what you mean by the different design objectives.

Technical Approach and Expected Deliverables

Matlab/Simulink Simulations.

Project # P12

Project Title: Design of a Sailing Boat Powered by Floating PV Panels.

Professor(s) Name(s): 1. Saad Alghuwainem

Number of Students: 2

Students Qualifications

Matlab/Simulink

Statement of Problem

PV-Powered sailing boat are available, but their disadvantage is that PV panels occupy large area of the boat surface. I this project, floating panels are proposed. They are dragged behind the boat, Their number, and hence output power is not limited by boat size. Their autonomous cleaning and cooling boost efficiency.

Brief Description of the Project

PV-Powered sailing boat are available, but their disadvantage is that PV panels occupy large area of the boat surface. I this project, floating panels are proposed. They are dragged behind the boat, Their number, and hence output power is not limited by boat size. Their autonomous cleaning and cooling boost efficiency.

Objectives

Often, the design has two to four specific objectives. You might consider listing them vertically as follows:

(1) Sizing of power output and optimize performance.
(2) Minimize drag force of floating PV panels.
(3) Minimize cost of the design.

In this section, you would discuss more fully what you mean by the different design objectives.

Technical Approach and Expected Deliverables

A prototype small boat powered by floating panels will be delivered

Project # P13

Graduation Design Project Proposal Form

Project Title: Effect of Circuit Parameters on the Performance of Self-Excited Induction Generator.

Instructors: Prof. A. Alolah and Dr. S. Al-Senaidi

Number of Students: Two

Students Qualifications

Courses: EE 330

Basic knowledge in MATLAB

Statement of Problem:

The need to deploy renewable energy resources in the production of electric power for remote communities as well as to complement the grid system call for the use of a power-generating device that is cheap and easily adoptable. The self-excited induction generator (SEIG) have attracted the attention of researchers as both meet the criteria of being cheap, flexible and robust. SEIG is basically an induction machine driven by a prime mover, while an external capacitor is connected across its stator terminals. Any variation in speed, load, and its power factor, and/or excitation capacitor will directly influence the machine performance.

Brief Description of the Project:

1. Conducting a comprehensive literature review of renewable energy generators.
2. Conducting a comprehensive literature review of induction generators and its applications..
3. Methods used to analyze the performance of Self-Excited Induction Generator.
4. Validation of the proposed methods using MATLAB.
5. Conducting experimental validation tests

Objectives:

1. Gaining knowledge about renewable energy sources and its advantages.
2. To have the ability of analyzing induction generators.
3. Understanding the influence of circuit parameters on the system performance.
4. Validating the analysis results via experimental tests.

Technical Approach and Expected Deliverables:

1. Developing MATLAB programs to conduct the needed analysis.
2. Arranging experimental tools to verify the obtained results experimentally.

Project # P14

Project Title: Effect of Circuit Parameters on the Performance of Three Phase Induction Motor.

Instructors: Prof. A. Alolah and Dr. S. Al-Senaidi

Number of Students: Two

Students Qualifications

Courses: EE 330

Basic knowledge in MATLAB

Statement of Problem:

The most important advantage of an induction motor is that its construction is quite simple in nature. The construction of the stator is similar in both synchronous motors as well as induction motors. However, a slip ring is required to feed DC Supply to the rotor in the case of a synchronous generator. These slip rings are not required in a squirrel cage induction motor because the windings are permanently short circuited. When compared with a DC Motor, the induction motor does not have brushes and hence, maintenance required is quite low. This leads to a simple construction. The working of the motor is independent of the environmental condition. This is because the induction motor is robust and mechanically strong. A squirrel cage induction motor does not contain brushes, slip rings and commutators. Due to this reason, the cost of the motor is quite low. However, slip rings are used in wound type induction motor to add external resistance to the rotor winding. Due to the absence of brushes, there are no sparks in the motor. It can also be operated in hazardous conditions. Unlike synchronous motors, a 3-phase induction motor has a high starting torque, good speed regulation and reasonable overload capacity. An induction motor is a highly efficient machine with full load efficiency varying from 85 to 97 percent.

Brief Description of the Project:

1. Conducting a comprehensive literature review of induction motor theory.
2. Methods used to analyze the performance of induction motor.
3. Analysis of the proposed methods using MATLAB.
4. Conducting experimental validation tests

Objectives:

1. Gaining deep knowledge about induction motor and its advantages.
2. To have the ability of analyzing induction motor.
3. Studying the influence of circuit parameters on the motor performance.
4. Validating the analysis results via experimental tests.

Technical Approach and Expected Deliverables:

1. Developing MATLAB programs to conduct the needed analysis.
2. Arranging experimental tools to verify the obtained results experimentally.