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8. Table of Contents
9. List of Tables
10. List of Figures
11. List of Symbols, Abbreviations or Nomenclature (Optional)
12. Chapters
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**HARNESSING HYDROELECTRIC POWER USING VERTICAL AXIS TURBINE**

## 

By

#### Mr. XYZ



National Institute of Technology Arunachal Pradesh

(Established by Ministry of Education, Govt. of India) Jote, District: Papum Pare, Arunachal Pradesh - 791 113

May, 2022

**HARNESSING HYDROELECTRIC POWER USING VERTICAL AXIS TURBINE**

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**Doctor of Philosophy**

By

**Mr. XYZ**

(Registration number)

Under the supervision of:

**Dr. ABC**

Assistant Professor

Department of Electrical Engineering



**DEPARTMENT OF ELECTRICAL ENGINEERING**

National Institute of Technology Arunachal Pradesh

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Jote, District: Papum Pare, Arunachal Pradesh 791 113

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# ABSTRACT

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Font size 12, Times New Roman --------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**Key Words:** 4 to 8 is allowed separated by semicolon

**LIST OF CONTENTS**

Certificate of approval i

Certificate of supervisor ii

Plagiarism undertaking certificate iii

Abstract iv

Acknowledgement v

List of Contents vi

List of figures vii

List of Tables viii

List of notations ix

Acronyms x

**CHAPTER 1**

INTRODUCTION

|  |  |  |
| --- | --- | --- |
| 2.1 | Introduction | …1 |
| 2.2 | Scope of the Dissertation | …2 |

**CHAPTER 2**

LITERATURE SURVEY ON FACTS

|  |  |  |
| --- | --- | --- |
| 2.1 | Introduction | …3 |
| 2.2 | What are FACTS devices | …4 |
| 2.3 | Benefits of utilizing FACTS devices | …5 |
| 2.4 | Better Utilization of Existing Transmission system assets | …6 |
| 2.5 | Application and Technical benefits of FACTS devices | …7 |
| 2.6 | Investment cost of FACTS devices | …8 |
| 2.7 | Maintenances of FACTS devices and operation of FACTS devices | …9 |
| 2.8 | How the World Bank can facilitate increased uses of FACTS devices | …10 |
| 2.9 | Static shunt compensator | …11 |
| 2.10 | Thyristor Control and Thyristor switch reactor | …12 |
| 2.11 | Thyristor switched capacitor | …13 |
| 2.12 | STATCOM | …14 |
| 2.13 | Comparison of Shunt compensators | …15 |
| 2.14 | Thyristor switched series capacitor | …16 |
| 2.15 | Thyristor Controlled series Capacitor   1. Blocking Mode 2. Bypass Mode 3. Capacitive Boost Mode 4. Inductive Boost Mode | …17 |
| 2.16 | GTO Thyristor controlled Series capacitor | …18 |
| 2.17 | Static synchronous series Compensator (SSSC) | …19 |
| 2.18 | Phase angle regulators | …20 |
| 2.19 | Comparison of series compensator …2.19 | …21 |
| 2.20 | Unified Power flow controller | `…22 |
| 2.21 | Interline power flow controller | …23 |
| 2.22 | SEN transformer | …24 |
| 2.23 | Real time transient of SEN transformer | …25 |

**CHAPTER 3**

LITERATURE SURVEY ON UPFC

|  |  |  |
| --- | --- | --- |
| 3.1 | Introduction | …26 |
| 3.2 | Basic operation and characteristic of Conventional UPFC | …27 |
| 3.3 | Operation and working of Conventional UPFC | …28 |
| 3.4 | Power flow in a Transmission line | …29 |
| 3.5 | UPFC with line fault current | …30 |
| 3.6 | UPFC with line fault current limitation | …31 |
| 3.7 | Three-level UPFC  3.7.1 Power System  3.7.2 Macro M1: PLL and Current Transformer  3.7.3 Macro M2: Shunt and DC control  3.7.4 DC link voltage control  3.7.5 AC bus voltage control  3.7.6 PWM Modulation | …32 |

**CHAPTER 4**

UPFC WITH MODIFIED DC LINK

|  |  |  |
| --- | --- | --- |
| 4.1 | Introduction | …33 |
| 4.2 | Power system Stability | …34 |
| 4.3 | New concept of power transmission | …35 |
| 4.4 | Characteristic of UPFC | …36 |
| 4.5 | Single phase UPFC Construction | …37 |
| 4.6 | 1. Shunt Side 2. Shunt Transformer 3. Rectifier 4. Series Side 5. Inverter 6. Pulse Generator 7. Series Transformer | …38  …40 |
| 4.7 | Affecting Factors  4.7.1. Harmonics  4.7.2. Problems caused by harmonics  4.7.3. Skin Effect | …48 |
| 4.8 | PU system in this project | …49 |
| 4.9 | UPFC with eliminated DC link  4.9.1. Mythology  4.9.2. Single phase model of UPFC with DC link Eliminated | …51 |
| 4.10 | UPFC with lengthened DC link | …53 |
| 4.11 | Observation | …54 |

**CHAPTER 5**

CONCLUSION AND FUTURE WORK

|  |  |  |
| --- | --- | --- |
| 5.1 | Conclusion | …56 |
| 5.2 | Future Work | …58 |
|  | References | …60 |
|  | List of papers based on Thesis (For M. Tech/M. S. / Ph. D. only) |  |
|  | Brief Curriculum Vitae (For M. Tech/M. S. / Ph. D. only) |  |
|  | Doctoral Committee (For Ph. D. only) |  |

List of Figures

|  |  |
| --- | --- |
| Fig: 2.1 Cost comparison | …2.4 |
| Fig. 2.2 Thyristor-Controlled Reactor | …2.7 |
| Fig 2.3 Two machine system with SVC in the middle | …2.7 |
| Fig 2.4 Thyristor-Switched Capacitor | …2.8 |
| Fig 2.5 Static Synchronous Compensator | …2.9 |
| Fig 2.6 Two machine system with STATCOM | …2.10 |
| Fig 2.7 V-I characteristics of the STATCOM (a) and the SVC (b) | …2.12 |
| Fig 2.8 Course of capacitor voltage for a basic element in a TSSC | …2.12 |
| Fig 2.9 Thyristor-Controlled Series Capacitor (TCSC) | …2.13 |
| Fig 2.10 Waveforms at various boost factors in capacitive boost mode | …2.14 |
| Fig 2.11 Boost factor versus conduction angle | …2.14 |
| Fig 2.12 Waveforms at various boost factors in inductive boost mode | …2.15 |
| Fig 2.13 GTO-Controlled Series Capacitor | …2.15 |
| Fig 2.14 Synchronous voltage source for compensation | …2.16 |
| Fig 2.15 Phase Angle Regulator | …2.17 |
| Fig 2.16 Transmitted power versus angle characteristics for a Phase Angle Regulator | …2.18 |
| Fig 2.17 dP/dσ Versus P | ...2.19 |
| Fig 2.18 Concept of the UPFC in a two-machine power system | …2.22 |
| Fig 2.19 Implementation of a UPFC | …2.22 |
| Fig 2.20 Interline Power Flow Controller | …2.23 |
| Fig. 2.21 (a) Power transmission system and (b) phasor diagram | …2.24 |
| Fig 2.22 (a) Phase angle regulator circuit and (b) phasor diagram | …2.26 |
| Fig 2.23 (a) Power transmission system and its series reactance emulator with a compensating voltage | …2.27 |
| Fig 2.24 SEN Transformer with transmission line. | …2.28 |
| Fig 3.1 Three-phase voltage sourced-converter | …3.4 |
| Fig 3.2 PWM converter (a) A phase-leg (b) PWM waveforms | …3.5 |
| Fig 3.3 Fundamental model of UPFC | …3.6 |
| Fig 3.4 Transmission line | …3.7 |
| Fig 3.5 UPFC on line fault | …3.9 |
| Fig 3.6 Series VSI converter application | …3.11 |
| Fig 3.7 Series voltage contribution to the fault current. | …3.12 |
| Fig 3.8 Equivalent sequence diagrams | …3.14 |
| Fig 3.8 3-level UPFC topology | …3.15 |
| Fig 3.9 Control system: Macro M1 | …3.17 |
| Fig. 3.9: Control system: Macro M2 | …3.18 |
| Fig. 3.10 and 3.11 Reference and carrier signals with Flat Top Control and phase adjustment and Reference and carrier signals with Flat Top Control without phase adjustment | …3.20 |
| Fig. 3.12 Control system: Macro M3 | …3.21 |
| Fig. 3.12 Transmission line: active and reactive | …3.22 |
| Fig. 3.13 Transmission line: phase currents | …3.22 |
| Fig. 3.14 DC link: voltages | …3.23 |
| Fig 3.15 Node N1: voltage | …3.23 |
| Fig 4.1 Unified Power Flow Converters | …4.2 |
| Fig 4.2 Line diagram of single phase UPFC | …4.3 |
| Fig 4.3 MATLAB simulation diagram | …4.4 |
| Fig 4.5 parameters of Rectifier | …4.5 |
| Fig 4.6 parameters of inverter | …4.6 |
| Fig 4.7 parameters of Pulse generators | …4.6 |
| Fig 4.8 parameters of Series Transformer | …4.7 |
| Fig 4.9 Reactive and active power output of normal UPFC | …4.7 |
| Fig 4.10 Fundamental with third and fifth harmonics | …4.8 |
| Fig 4.11 Equivalent PU diagram | …4.11 |
| Fig 4.12 Schematic Diagram of separated UPFC | …4.13 |
| Fig 4.13 Single phase model of UPFC with DC link omitted | …4.14 |
| Fig 4.14 Reactive and active power of DC link eliminated UPFC | …4.14 |
| Fig 4.15 the injected voltage and line current of DC link separated UPFC. | …4.15 |
| Fig 4.16 Line diagram of UPFC with lengthened DC link. | …4.16 |
| Fig 4.17 MATLAB model of lengthened DC link UPFC. | …4.17 |
| Fig 4.18 Reactive and active power of DC link extended. | …4.18 |
| Fig 4.19 The injected voltage and line current of DC link extended. | …4.18 |
| Fig 4.20 Comparison of two active powers. | …4.19 |
| Fig 4.21 Active power foe long duration of time. | …4.20 |

###### LIST OF NOTATIONS

**Notations Descriptions**

Pm Mechanical Power, Watt

Pe Electrical Power , Watt

ρ Air Density, Kg/m3

Pm Mechanical Power, Watt

Pe Electrical Power , Watt

ρ Air Density, Kg/m3

Pm Mechanical Power, Watt

Pe Electrical Power , Watt

ρ Air Density, Kg/m3

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ρ Air Density, Kg/m3

Pm Mechanical Power, Watt

Pe Electrical Power , Watt

###### ACRONYMS

|  |  |
| --- | --- |
| FACTS | - Flexible AC Transmission System |
| OH | - Over Head |
| UPFC | - Unified Power Flow Controller |
| VSC | - Voltage Source Converter |
| TCR | - Thyristor –Controlled Reactor |
| TSR | - Thyristor – Switch Reactor |
| STATCOM | - Static Synchronous Compensator |
| SSC | - Static Series Compensator |
| TCSC | - Thyristor Controlled series Compensator |
| GTO | - Gate Turn Off |
| PAR | - Phase Angle Regulator |
| PST | -Phase Shifting transformer |
| IPFC | - Interline power flow Controller |
| OLTC | - On Load Tap Changer |
| LF | - Load Flow |
| PWM | - Pulse Width Modulation |
| PAR | - Phase Angle Regulator |
| PST | -Phase Shifting transformer |
| IPFC | - Interline power flow Controller |
| OLTC | - On Load Tap Changer |
| LF | - Load Flow |
| PWM | - Pulse Width Modulation |

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The dedication is brief, single-spaced, and centered on the page (horizontally and vertically). No heading is used. The word "To" customarily begins the dedication.

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Use only Arabic Numerals. Chapter Numbering should be centered on the top of the page using large bold print.

Example:

**CHAPTER 1**

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A chapter can be divided into **Sections, Sub-sections and Sub-sub-sections** so as to present different concepts separately. Sections and sub-sections can be numbered using decimal points, e.g., 2.2 for the second Section in Chapter 2 and 2.3.4 for the fourth Sub- section in third Section of Chapter 2. Use only Arabic Numerals with decimals. Section numbering should be left justified using large bold print.

Example:

###### GENERAL

* 1. **ADSORPTION**

Sub Sections

Use only Arabic Numerals with two decimals. Sub section numbering should be left justified using large bold print.

Example:

###### Adsorption Isotherms

* + 1. **Langmuir Isotherms**

**etc.**

###### Review of Literature

This shall normally the **Chapter 2** and shall present a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation. The extent and emphasis of the chapter shall depend on the nature of the investigation.

For Example,

Several researchers attempted to develop mathematical models to simulate the activated sludge process. Some of these models simulate the organic removal mechanisms in wastewater treatment field, which were included in Jorgensen and Gromiec (1985), Henze (1986), Henze et al. (1987a), Tang et al. (1987), and Van Niekerk et al. (1988). The oxygen transfer mechanism has an important place in the activated sludge process. An estimation technique for the oxygen transfer capacity is investigated by Stenstrom et al. (1989).

1. Results and Discussions

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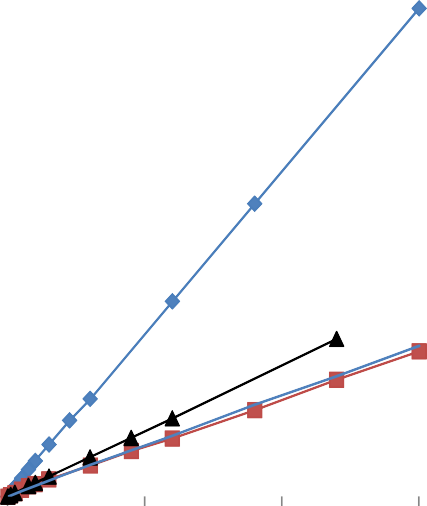
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All the equations should be typed in equation editor and should be properly numbered For Example,

*X* α X*t* (2.1)



500

450

SSiizzee

4” X 5”

400

350

300

250

200

Cu - RRH Cu - RHA

Pb- RRH

150

100

50

0

100

200

300

400

**Time min**

*Fig. 10. Pseudo Second order plot for Copper and Lead on RRH and RHA*

###### Table 5 Desorption Study

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cycle** | **Metal/ Adsorbent** | **Copper** | | **Lead** | |
| **RRH** | **RHA** | **RRH** | **RHA** |
| 1 | Adsorption | 73% | 97.5% | 81% | 98% |
| Desorption | 99% | 99.5% | 98.5% | 99% |
| 2 | Adsorption | 40% | 30% | 80% | 38% |
| Desorption | 99% | 99% | 98% | 99% |

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###### References

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*ASCE: Jour.Env.Engg,* **122**, 4-8.

1. Papers with Two Authors,

**Bliss, P. J. and D. Barnas** (1986) Modeling Nitrification in Plant Scale Activated Sludge.

*Water Science and Technology*, **18**,139-148.

1. Papers with more than two Author,

**Capodaglio, A.G., H.V. Jones, V. Novotny and X. Feng** (1991) Sludge bulking analysis and forecasting: application of system identification and artificial neural computing technologies. *Water Res.,* **25**, 1217–24.

1. Books

**APHA, AWWA and WPCF** *Standard methods for the examination of water and wastewater*, 17th Edition, Washington, D.C.: American Public Health Association, 1989.

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Sections : 12 pts bold left aligned (Capital Letters)

Subsections : 12 pts bold left aligned (Title case) Page numbers (Chapters) : Bottom – centered – 12 pts (1, 2, 3…)

Page numbers (Preliminaries): Bottom – centered – 12 pts / Roman numerals (i, ii, iii….) Binding : Soft binding (edge with black color strip)

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