

# **EVALUATION OF CATASTROPHIC INDICATOR FOR POWER SYSTEM STABILITY ASSESSMENT**

*A Progress Report submitted in partial fulfilment*

*of the requirements for the degree of*

**Master of Technology**

in

**Electrical Engineering**

*(Specialization in POWER SYSTEM ENGINEERING)*

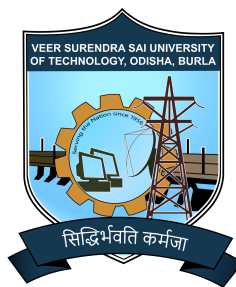
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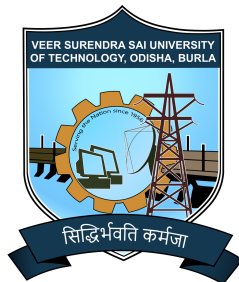
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**April 2022**

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## **CERTIFICATE**

This is to certify that the work contained in the Project Work entitled “**EVALUATION OF CATASTROPHIC INDICATOR FOR POWER SYSTEM STABILITY ASSESSMENT**”, submitted by **Subha Biswal** (Regd. No.: 1704050016) for the award of the degree of master of Technology in Electrical Engineering during the Academic Year 2021-2022 to the **Veer Surendra Sai University of Technology, Burla**, is a record of bonafide research work carried out by him under my direct supervision and guidance.

I considered that the project work which is modified as per the suggestions of the examiners has reached all prescribed requirements of the rules and regulations relating to the nature of the degree. The contents incorporated have not been submitted elsewhere for the award of any other degree.

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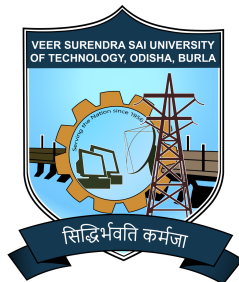
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**CERTIFICATE OF APPROVAL\***

This is to certify that we have examined the dissertation entitled **“EVALUATION OF CATASTROPHIC INDICATOR FOR POWER SYSTEM STABILITY ASSESSMENT”**, submitted by **Subha Biswal** (Regd. No.: 1704050016) in partial fulfillment for the degree of **Master of Technology** with specialization in **Power System Engineering** at the Department of Electrical Engineering of **Veer Surendra Sai University of Technology, Burla, Odisha**.

We hereby accord our approval of it as a dissertation work carried out and presented in a manner required for its acceptance for the partial fulfillment for the award of degree of Master of Technology in Electrical Engineering with specialization in Power System Engineering for which it has been submitted. The approval does not necessarily endorse or accept every statement made, opinion expressed or conclusions drawn as recorded in this thesis. It only signifies the acceptance of the thesis for the purpose it has been submitted.

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# ABSTRACT

Though broad work is accounted for on different catastrophic indicators for the appraisal of power system stability, the relative evaluation has not gotten a lot of consideration by the analysts. With the approach of wide area management system (WAMS) innovation and close to real-time instruments accessible, these indicators can assume a significant part in operation and control of the framework. Indicator's choice depends on various performance deciding factors like accuracy, security, mis-detection, reliability and false-alarm), which utilize a typical stage for assessment. The methodology begins by producing a contingency dataset of an organization, trailed by acquiring the organization estimations to the contingency dataset. These estimations are utilized as a contribution to the indicators for recognizing stability or instability cases. The performance measures are processed to every indicator for their appraisal. Notwithstanding the above performance measures, strength and affectability are acquired to every pointer. Ongoing work has reached till getting curves for the variety of generator angles regarding the system COI. Additionally, IEEE 10 bus 4 generator system and IEEE 145 bus 50 bus generator are used for observing the procedure.

***Keywords:***

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# Some Important Abbreviations

<b>AHP</b>	Analytical Hierarchy Process
<b>ACM</b>	Approved Consolidated Methodology (CDM)
<b>AMS</b>	Approved Methodology for Small scale projects
<b>Beta-PD</b>	Beta probability distribution
<b>BAU</b>	Business-as-usual
<b>CA</b>	Cost Additionality
<b>CCV</b>	Coefficient of variation of cost
<b>CDF</b>	Cumulative Distribution Function
<b>CDM</b>	Clean Development Mechanism
<b>CEA</b>	Central Electricity Authority
<b>CF</b>	Capacity Factor
<b>CO</b>	Compromise solution
<b>CS</b>	Cost Savings
<b>DFIG</b>	Doubly Fed Induction Generator
<b>EA</b>	Emission Additionality
<b>ECV</b>	Coefficient of variation of emission
<b>ED</b>	Economic Dispatch
<b>EED</b>	Economic Emission Despatch
<b>ER</b>	Emission Reduction
<b>EF</b>	Emission Factor
<b>FACTS</b>	Flexible AC Transmission System
<b>GOF</b>	Goodness-of-fit test
<b>GSC</b>	Grid side converter

<b>JM</b>	Justus and Mikhail
<b>IC</b>	Installed Capacity
<b>IPM</b>	Interior Point Method
<b>MC</b>	Minimum Cost solution
<b>MCDA</b>	multi-criteria decision analysis
<b>MCS</b>	Monte Carlo Simulation
<b>ME</b>	Minimum Emission solution
<b>MO</b>	Multi-objective solution
<b>PD</b>	Probability Distribution
<b>PDF</b>	Probability Distribution Function
<b>PLA</b>	Real Power Loss Additionality
<b>PLCV</b>	Coefficient of variation of $P_{loss}$
<b>PEM</b>	Point Estimate Method
<b>QLA</b>	Reactive Power Loss Additionality
<b>QLCV</b>	Coefficient of variation of $Q_{loss}$
<b>RES</b>	Renewable Energy Sources
<b>RSC</b>	Rotor side converter
<b>RV</b>	Random variable
<b>SD</b>	Standard deviation
<b>TG</b>	Thermal generator
<b>TPP</b>	Thermal Power Plant
<b>VWS</b>	VSSUT weather station
<b>VPL</b>	Valve point loading
<b>W-PD</b>	Weibull probability distribution
<b>WES</b>	Wind energy share
<b>WG</b>	wind generator
<b>WRA</b>	Wind Resource Assessment
<b>WSC</b>	Wind Shear Coefficient
<b>WSF</b>	Wind Speed Forecasting
<b>WTPC</b>	Wind Turbine Power Curve

# **Chapter 1**

## **Introduction**

### **1.1 Introduction**

### **1.2 Project Motivation**

ion V enumerates the conclusions drawn from this work.

### **1.3 Literature Review**

### **1.4 Objective of the Work**

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## **1.5 Thesis Organisation**

Chapter 2	Explains the basics of
Chapter 3	Tells about the
Chapter 4	Deals with the results of
Chapter 5	Highlighted the conclusion based on project and future scope based on present thesis.

## **Chapter 2**

### **Problem Formulation**

#### **2.1 General Terminologies used for Stability Assessment**

#### **2.2 Catastrophic Indicators**

# **Chapter 3**

## **Software Description**

### **3.1 Introduction**

### **3.2 MAT-POWER Tool Box**

#### **3.2.1 Economic Load Dispatch Example on IEEE-9 Bus System**

### **3.3 MAT-TRANS Software**



## **Chapter 4**

# **Probabilistic optimal power flow with wind uncertainty**

### **4.1 Introduction**

### **4.2 Discussion**

# **Chapter 5**

## **Evaluation of Additionality of wind power after integration**

### **5.1 Introduction**

### **5.2 Discussion**

# **Chapter 6**

## **A composite index for wind integrated power systems**

### **6.1 Introduction**

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## **Chapter 7**

### **Conclusions and future scope**

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