STUDY OF THE SETTINGS OF OVER SPEED PROTECTION FOR ENHANCING FREQUENCY STABILITY: A CASE STUDY FOR LAKVIJAYA POWER STATION

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Degree of Master of Science

Department of Electrical Engineering

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Master thesis under my supervision.

Signature of the supervisor:

Dr. W. D. Prasad **Eng. Rienzie Fernando**

DEDICATION

This work is dedicated to my beloved parents.

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Abstract

The main target of the large interconnected Power Systems (PS) present today is to provide continuous and quality electricity supply to the consumers with highest possible reliability. “Fast Valving” (FV) action of Steam Turbines is one of the most effective elements for enhancing the transient stability of a power system in order to maintain a healthy power supply under the large and sudden disturbances. FV plays a significant role in mitigating the impact of sever disturbances by instantly decreasing steam turbine power, thus ensuring the Power System Stability (PSS).

Sri Lankan power system currently comprises 4,043 MW generation capacity consisting of 900 MW of coal power, 1,215 MW of oil burning thermal power, 1,720 MW of hydropower and 208 MW of non-conventional renewable energy sources such as wind, mini hydro, biomass, and solar power plants. Lak Vijaya Power Plant (LVPP) is the first and only coal power plant which is connected to Sri Lankan Power System and it contributes almost 45% of total power requirement of the nation. LVPP has three identical generating units driven by steam turbines each having 300MW capacity.

Main objective of this research was to study the behaviour of “Over Speed Protection Control” (OPC) unit of LVPP which has almost the same function of FV and to establish the main objective of the OPC function. This study further investigates the effects of FV scheme of LVPP on the transient stability of Sri Lankan Power System.

The study further explores the procedure to obtain the optimum valve actuation timing of the Intercepting Valves (IVs) for the FV scheme while proving that FV has much better control over transient stability than OPC. The results of the study further unveil that proper selection of actuation timings of IVs for FV scheme of LVPP steam turbines has a significant effect on enhancing the power system frequency stability under transient conditions.

As the main objective of this study, the optimum ranges for actuation timings of IVs for FV scheme of LVPP were found based on frequency stability of Sri Lankan power system under the transient conditions and a set of timings for FV scheme were recommended to set as actuation timings of IVs. The sensitivity of each time settings were also examined and the relationships were clearly established.

Keywords: Fast Valving (FV), Over speed Protection Control (OPC), Power System (PS), Lakvijaya Power Plant (LVPP), Large Disturbances, Optimum Time Settings, Transient Stability.

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List of Abbreviations

Abbreviation	Description
CEB	Ceylon Electricity Board
FV	Fast Valving
GV	Governor Valve
HP	High Pressure
IP	Intermediate Pressure
IPP	Independent Power Producers
IV	Intercept valve
LP	Low Pressure
LVPP	Lakvijaya Power Plant
OPC	Over Speed Protection Control
PS	Power System
PSS	Power System Stability
RE	Renewable Energy