STABILITY AND SECURITY ANALYSIS OF INDIA-SRI LANKA HVDC INTERCONNECTION

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Declaration

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Dedicated to my Family

My parents, my husband Shami Mudunkotuwa and my baby girl Yanuli

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Abstract

This thesis concentrates on the stability performance of HVDC-HVAC interaction of the transnational HVDC interconnection between Sri Lanka and India. This transmission line was under consideration since mid-1970 and the prefeasibility study was done by India in cooperated with Sri Lanka together. In this study it was focused on modeling the HVDC link between Indian and Sri Lankan power grids with the basic control system and studying the transient stability performance of the HVDC interconnection under the Sri Lankan transmission network perturbed conditions. The complete system was modeled on PSCAD/EMTDC software. The complete system was divided into five subsystems while modeling as, rectifier side AC source, converter transformers and converters, DC transmission line, HVDC control system and inverter side detailed Sri Lankan network. The simulations were done for steady state conditions, for system accuracy verification and for different system perturbed conditions. The analysis was done based upon the maximum power curve, Short circuit ratio (SCR) and time domain analysis. It was found that; modeled Sri Lankan network is a strong network for the proposed HVDC interconnection in steady state condition. However, there is a considerable impact on the stability of HVDC-HVAC interaction under different perturbed scenarios of Sri Lankan AC network. This study discusses the results obtained from the qualitative and quantitative analysis.

The results obtained from this study can be taken as guidance during the planning and designing stage of the proposed DC interconnection to have an idea on stability of the AC-DC interaction. The DC power operating curve, maximum DC power in-feed to inverter side Sri Lankan network, AC system strength behavior during different disturbances, time domain faults behavior, impact of AC system impedance on the stability are the facts which are discussing in this thesis. Therefore, this thesis can be consider as guidance for the planning stage of the proposed interconnection.

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List of Abbreviations

Abbreviation	Description
AC	Alternative current
CC	constant current
CSC	Current source converter
CEA	Constant extinction angle
CEC	Current error control
CIA	Constant ignition angle
DC	Direct current
DMPC	Dynamic maximum power curve
ESCR	Effective short circuit ratio
HVDC	High voltage direct current
MPA	Maximum power availability
MPC	Maximum power curve
QMPC	Qusi-static maximum power curve
SCR	Short circuit ratio
VDCL	Voltage dependent current order limit
VSC	Voltage source converter