Developing Algorithm and Program for Power Flow Analysis in Power System with VSC-HVDC*

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Abstract

The demand for higher controllability in AC grids and/or interconnection of asynchronous systems with different frequency make Voltage Source Converter - HVDC link (VSC-HVDC links) an attractive technology for most power transport in meshed grids. Advantages are the high controllability of active and reactive power at the converter's terminals and the ability to increase the stability of the surrounding AC system. VSC-HVDC can provide active and reactive control to achieve maximum power transfer, system stability and improve power quality and reliability.

This research aims to develop a mathematical model and an algorithm for the analysis of power flow in a steady state of power system containing VSC-HVDC.The Jacobian matrix inNewton-Raphsonalgorithm, which is the relationship between voltage and power mismatches, is extended with the VSC HVDC variablesto control active and reactive powers and voltage magnitude in any combination. A Newton-Raphson load flow program has been developed which includes comprehensive control facilities and exhibits very strong convergence characteristics. Two scenarios have been studied, back-to-back VSC-HVDC link and full VSC-HVDC link connecting two buses in AC networks. The algorithm and the program have been verified through a number of simulation examples carried out on IEEE 14-bus System.

Keywords: **VSC-HVDC, FACTS, Newton-Raphson, load flow algorithm, HVDC link, load flowanalysis.**

* For the paper in Arabic see pages (191-209)

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