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An algorithm for DC segmentation of AC power systems to mitigate electromechanical oscillations

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Abstract-

In the last decades, various events have shown that electromechanical oscillations are a major concern for large interconnected Alternative Current (AC) power systems. DC segmentation - a method that consists in turning large AC grids into a set of asynchronous AC clusters linked by Direct Current (DC) links - is a promising solution to mitigate this and other issues. However, no systematic segmentation procedure for a given AC power system exists so far. This paper aims at filling this gap and proposes an algorithm for DC segmentation for a given AC power system to mitigate electromechanical oscillations. In this proposal, DC segmentation is implemented with High Voltage Direct Current links based on Voltage Source Converters (VSC-HVDC). The algorithm uses small-signal stability techniques and the concept of dominant inter-area oscillation paths to eliminate the main inter-area mode of the power system. The algorithm will be explained using a six-generator test system and it will then be used on the Nordic 44 test system. The proposed algorithm for DC segmentation has been validated by means of non-linear timedomain simulation and small-signal stability analysis (SSSA).

Index Terms- HVAC/HVDC, Voltage Source Converter, VSC-HVDC, power system stability, inter-area oscillations, electromechanical oscillation damping, DC segmentation, dominant path.

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