

Title

Impedance analysis of electrical resonance and harmonics in HVDC connected Wind Power Plants

Summary of the Master Thesis

During the last years the development of first HVDC connected offshore wind power plants increased. As the first wind farms of this type were commissioned, an unexpected phenomenon occurred. The phenomenon of electrical resonance in the offshore AC grid led to outages of the HVDC transmission system. The thesis presents the phenomenon and methods of its investigation.

The study focuses on harmonic frequencies identification excited through the resonance phenomena between the elements within WPP's inner AC network. The analysis includes observations from three tested topology cases by different methods: frequency sweep and harmonic resonance modal analysis. The comparison is performed for diverse converter models: voltage source based, current source based and nonlinear impedance model obtained by harmonic linearization method. The results of the analysis are verified by the outcome attained in DlgSilent Power Factory software. The study also includes the stability analysis performed Nyquist criterion based.

Furthermore, the result of investigation exposes the clues for possible subsequent implementation of harmonic filters as well as for beneficial control of converters. Feasible measures for resonance mitigation by these two approaches are briefly described.