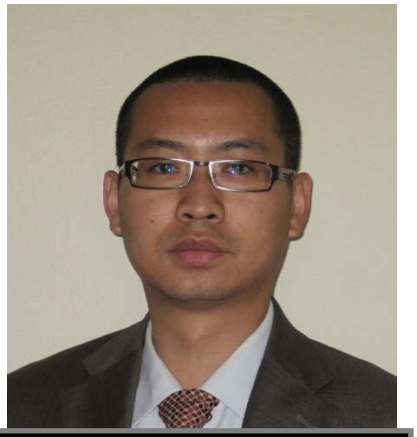
SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

OFFICE OF ECONOMIC DEVELOPMENT

Tieline Reconnection Utilizing Virtual-Air-Gap Variable Reactors



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LICENSING OPPORTUNITIES

South Dakota School of Mines Office of Economic Development is actively seeking exclusive and/or nonexclusive licensing opportunities. Joint development opportunities are also available.

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Overview

A smooth and transient-free tieline reconnection of an electric power grid is realized by controlling a variable reactor (VR) based on virtual-air-gap (VAG) technology. The concept of VAG-VR is to saturate a certain portion of the magnetic core of the reactor to change the reactance. Virtual air gap is not an actually air gap but a saturated portion of the magnetic core, which restricts the magnetic flux to follow through it. The saturation is created by adding dc winding current in a certain part on the magnetic core. By changing the dc current, the variable reactance can be achieved. The power rating of the power electronics drive in VAG-VR can be much smaller than the power rating of the constant reactor in VAG-VR, which would greatly reduce the cost of variable reactor devices.

During tieline reconnection, the reactance is initially high enough to limit power flow and then gradually reduces to a low value with a tuned controller for the dc current source. The to-be-connected power grid can be smoothly reconnected into the utility with minimized transients and oscillations. This is a cost-effective approach to enhance the stability of the entire electric power system nowadays and smart grid in future, i.e. 1) a microgrid and utility grid; 2) interconnecting microgrids.

Impact and Benefits

The present methods highly rely on the communication and control network of microgrids, which is not available most of time, especially in large-scale microgrid (>10 MW). This invention would increase the allowable capacity of renewable energy penetration into the existing utility while maintaining satisfactory system stability according to code and standard.

Advantages:

- very high feasibility
- cost-effective
- easy to operate
- high reliability
- low power loss