

Implementation of the power transistor assisted Sen transformer in steady-state load flow analysis

ABSTRACT

The wide use of power flow controllers (PFCs) in transmission and distribution grids is becoming imperative. Power transistor-assisted Sen transformer (TAST) is a very recently introduced novel PFC that bridges the gap between most versatile flexible AC transmission systems controllers. It proved to possess closely comparable technical characteristics to that of the unified power flow controller (UPFC) at an installation cost that is less than the half. It is thus an attractive substitute of the UPFC for many utility applications. Nonetheless, since the TAST is a newly introduced PFC, it is of great importance to develop its steady-state model for its implementation in modern power systems analysis. The main contribution of this study is presenting two accurate steady-state models of the TAST: a simplified Simulink model (SSM) and a comprehensive Newton-Raphson model (CNRM) for its representation in the load flow analysis. The presented SSM and CNRM of the TAST are novel. A standard five-bus system and a modified IEEE-30 bus power system are used for demonstration of the effectiveness and validation of the SSM and the CNRM. Very closely comparable results are obtained when a TAST or more is used to increase and decrease the power flow in transmission lines.

Keyword: Flexible AC transmission systems; Load flow control; Newton-Raphson method; Power grids; Power transformers; Power transistors.