

Variable frequency transformer (VFT) combines the principles of rotary transformer and phase shifting transformer to control active power transfer between two electric grids. The active power transfer control concepts, design, and transient performance of the VFT have been studied in detail and are reported in the literature. However, reactive power flow through the VFT has not been studied so far. In the existing installations, in order to meet the VFT internal reactive current requirements (magnetizing), switched capacitor banks are being used on the two sides of the VFT. These switched capacitor banks are oversized to deal with uncontrolled reactive power exchange that can happen between the two networks through the VFT. This may achieve desired power factor operation, but cannot prevent the undesired reactive power exchange. This paper presents the detailed study on reactive flow through the VFT. The paper also proposes a new VFT configuration (with integrated partially-rated series voltage compensation scheme and corresponding control) to achieve a full control over reactive power flow. Thereby, the proposed configuration can achieve the bidirectional and decoupled active and reactive power flow through VFT. The proposed VFT configuration and control are validated using real-time hardware in-loop evaluations.