

Abstract

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Custom Power Active Transformer for Flexible Operation of Power Systems

This paper presents a new transformer, i.e., the Custom Power Active Transformer (CPAT) which integrates both series and shunt power conditioning through power electronics in a single transformer. This is achieved through a distinct design of the magnetic circuit and auxiliary windings of the transformer. In this paper, a single-phase CPAT is proposed as well as a preface into its extension to multi-phase systems. Through its magnetic equivalent circuit model, several design considerations and control limitations are revealed in the paper. Analysis of the resulting CPAT structure shows some prospects in material saving as well as size and cost reduction when compared to the traditional multi-transformer based configuration. In this paper, the proposed single-phase CPAT is utilized in a distribution system application, where the control architecture is designed to attenuate voltage and current distortions at both the load and the grid side, respectively. Performance and effectiveness of the proposed CPAT are evaluated through simulation and experiments.