

On the power-flow limits and control in series-connected custom power devices

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Abstract— Power electronic devices connected in series with electrical distribution lines have been proposed for some time to protect sensitive loads from voltage sags, voltage harmonics, and unbalances. Full understanding of active- and reactive-power consumption in the device is important in order to minimize losses and to provide reactive-power compensation while leaving the load undisturbed. However, a comprehensive description of power flow in series custom power devices has not been presented yet. This paper proposes a control framework where active and reactive power consumed by series devices can be analyzed and controlled. The method proposed is based on a reference frame synchronized with the load current, which greatly simplifies the power calculations and makes it possible to take into account the load-voltage constraints to guaranty safe operation of the load. The proposed method has been tested on a 5-kVA prototype of a series active conditioner.

Index Terms— AD-DC power conversion, control systems, power electronics

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