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Abstract

In the future communication systems, it is of key importance that the transceivers are capable of operating in multiple frequency bands and with complex signals. In this context, the power amplifier is a critical component of the transceiver, since it is responsible for most of the total power consumption in base stations and portable devices. Apart from the power consumption, the design of power amplifier systems must account for multi-band/broadband capabilities, high peak-to-average power ratio signals and the mismatch effect caused by the various operating conditions. Hence, the design of power amplifier topologies that enhance the total system efficiency and reliability is a challenging task.

This PhD dissertation introduces novel power amplifier architectures and solutions for modern communication systems. The contributions of this thesis can be divided in two parts. The first part deals with the study and design of power amplifier systems. It is of major importance that these designs provide linear amplification and operation at multiple frequency bands, which will permit the reduction of the cost and size of the devices. Additionally, we investigate the possibility to harvest the dissipated power from the power amplification process. For the development of the prototypes, lumped-element topologies, transmission line implementation and Substrate Integrated Waveguide (SIW) technology are adopted.

In the second part of the thesis, novel matching networks are introduced and their properties are studied. In particular, resistance compression topologies are proposed to overcome the performance degradation associated with the sensitivity of nonlinear devices to environmental changes. These networks can be adopted in modern power amplifier architectures, such as envelope tracking and outphasing energy recovery power amplifier topologies, in order to provide improved performance over a wide range of operating conditions.

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Design of Efficient Microwave Power Amplifier Systems

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