Tunable Microwave Devices for Smart Systems

R. Allanic, C. Quendo, D. Le Berre, Y. Quéré
Lab-STICC / University of Brest, 6, Avenue Le Gorgeu, CS 83818, 29238 Brest Cedex 3, France.

The digital society requires major technological challenges with the rise of high-speed communication systems. As they are numerous and versatile, the systems have to be smart. This induces some needs on microwave devices, which have also to become smart. Therefore, design of switches, filters, antennas… are more and more constraint in order to make possible the cohabitation of all these smart objects. The microwave devices have to reach good performances, and this with a small size and low cost. To reduce the system's size, a solution is to use tunable components. However, the classical way that consists in adding active components on passive devices shows some limitations. Moreover, this is accentuated with the rise in frequency where the active component interconnection size causes parasitic effects. A novel approach consists in thinking in a global design the active and passive parts of the tunable devices based on the use of a silicon substrate. With a similar manufacturing process of semiconductor components, this particular substrate applied on microwave devices, offers the possibility to have integrated active elements in the substrate. Moreover, designing the tunable components in a global way offers a great flexibility with the choice of active elements size and shape (they can be small or big or with a particular shape). This co-design approach can be applied to switches, tunable filters or reconfigurable antennas.

Name: Dr. Rozenn ALLANIC
University: Université de Bretagne Occidentale / Lab-STICC
Department: Electronic
Email: Rozenn.Allanic@univ-brest.fr

Education

PhD (2012-2015) in Electrical Engineering, at Université de Bretagne Occidentale, France

Thesis untitled: "Modelisation and design of tunable microwave devices on a silicon substrate: study of a new co-design concept"

Master (2012) in electronics of communications systems, at Université de Bretagne Occidentale, France

Research Area

My research activities concern the microwave devices and my actual works focus on a **novel solution of co-designing tunable microwave functions**, such as switches, antennas and filters. This co-design between an active element and a passive component is based on the use of a silicon substrate. The active element is made with semiconductors junctions (dimensioned with a low or big size or a particular shape) and acts as an ON / OFF switch and it is integrated in the substrate. Semiconductor junctions are analysed to show the impact of the bias voltage on their electrical characteristics, which are included in the electromagnetic analysis of tunable microwave devices. This method offers a great

flexibility in designing microwave devices without surface mounted devices (SMDs) and associated parasitic effects ; a low switching voltage, and good performances can be reached.

Publications & Patents

C. Quendo, R. Allanic, D. Le Berre, Y. Quéré, "Novel Approaches to Design Tunable Devices", IEEE 18th Wireless and Microwave Technology Conference (WAMICON) 2017

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R. Allanic, Y. Quéré, D. Le Berre, C. Quendo, "A Novel Approach to Co-Design Microwave Devices with Distributed Switches", Asia Pacific Microwave Conference Proceedings, APMC 2016.

R. Allanic, Y. Quéré, D. Le Berre, C. Quendo, "Intrinsically microwave tunable resonator designed on silicon", *Electron. Lett.*, vol. 52, no. 20, pp. 1697–1699, Sep. 2016.

R. Allanic « Modélisation et conception de fonctions accordables sur substrat semi-conducteur : étude d'une nouvelle démarche de co-conception », Université de Bretagne Occidentale, Lab-STICC, 2015.

« Antenne filaire améliorée à large bande fréquences », Jousset Michel, Mallegol Stéphane, Allanic Rozenn. FR3003702-A1. 2014.
Available : http://patent.ipexl.com/FR/3003702-a1.html