Reconfigurable antennas and arrays for cognitive radio: polarization and frequency agility and beamforming

WS4: In Memoriam of Julien Perruisseau-Carrier

A. Georgiadis
Centre Tecnologic de Telecomunicacions de Catalunya (CTTC), Spain

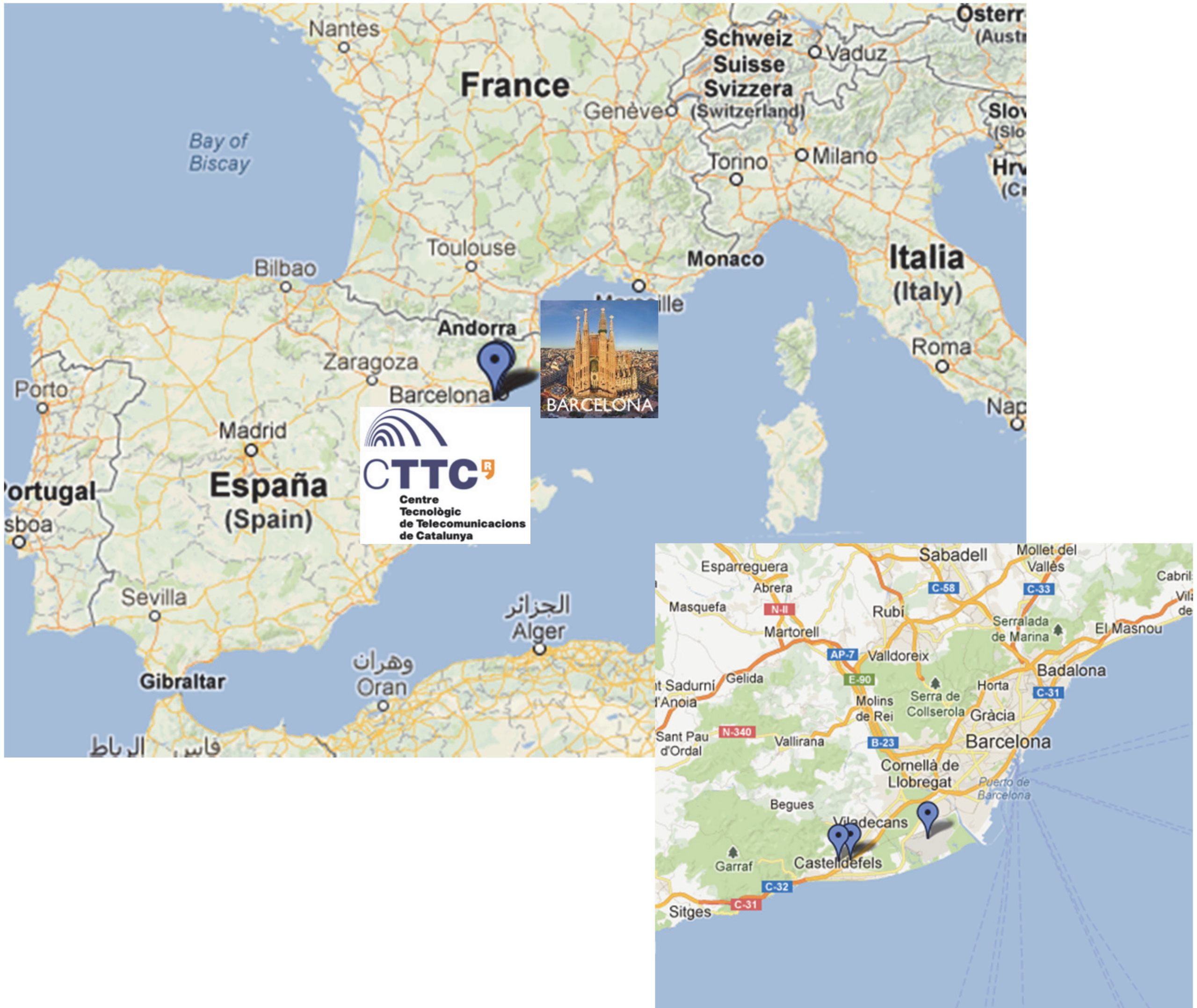
14 Apr. 2015

CTTC
Centre
Tecnològic
de Telecomunicacions
de Catalunya

Outline

- Introduction
- Communication Subsystems Area
- Reconfigurable circuits
- Barcelona

Introduction

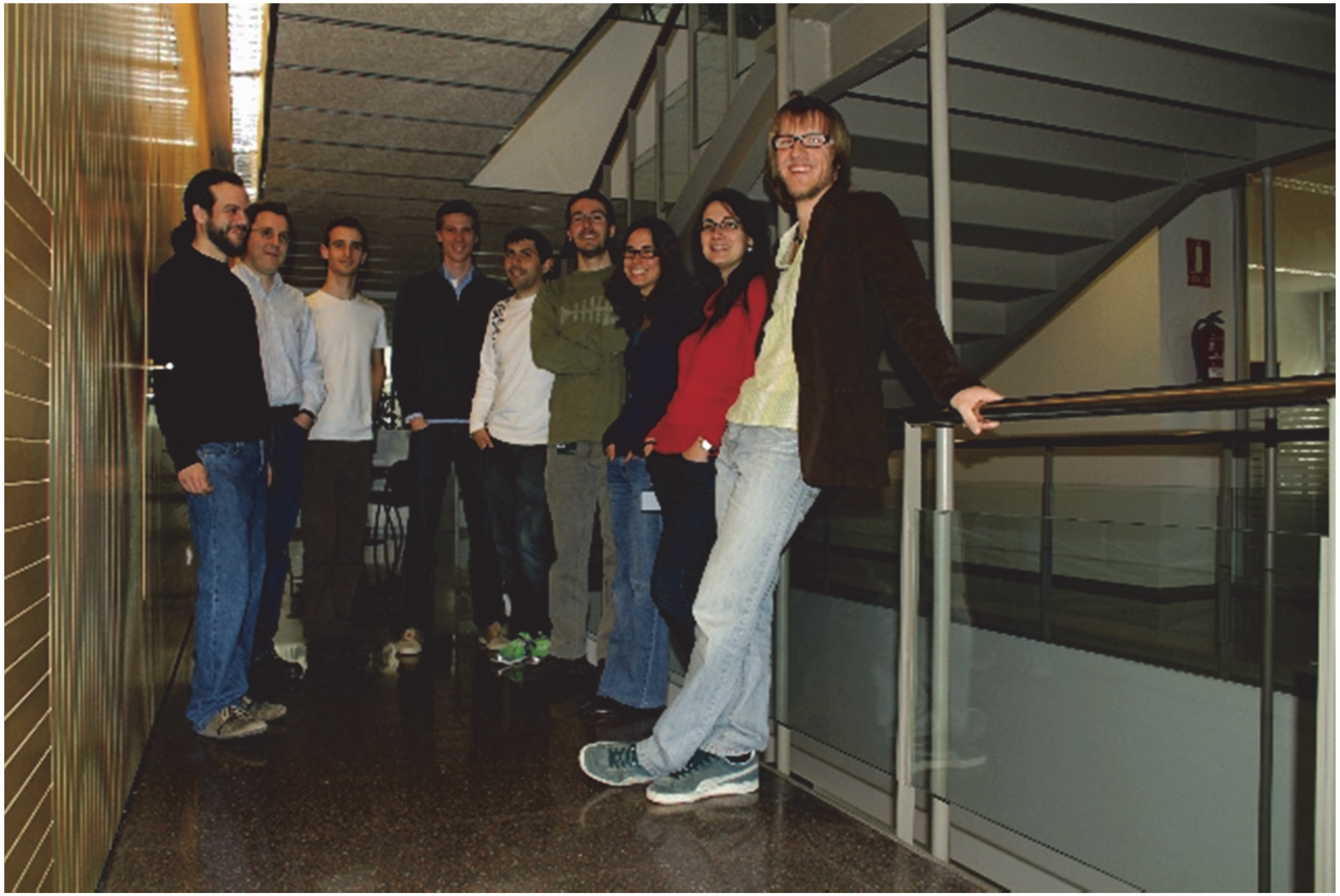


Introduction

- Centre Tecnologic de Telecomunicacions de Catalunya
  - Founded in 2001
  - Research Staff: 45 Ph.D. and 25 M.Sc.
- NOW (2013 -) Four Research Divisions
  - Communication Networks, Systems, Technologies & Geomatics
- **THEN (2006 – 2013) Communication Subsystems Area**

Introduction

- Communication Subsystems Area



Introduction

- Calçotada 2008 !

Weekly Seminar 30/01/2008

Weekly Seminar 30/01/2008

- Periodic structure modeling
- Distributed MEMS Transmission Lines (DMTL)
- Composite Right/Left Handed Transmission Lines (CRLH-TL)
- Reflectarray cells

Research

- **Projects (2008-2011):**

- **NARRA TEC2008-02685. N**uevas **A**rquitecturas para **R**eflectarrays **R**econfigurables y **A**ntenas phased-array
  Also (***Star Wars***) : Commander Arhul Narra, leader of the Alliance to Restore the Republic's Red Squadron prior to the Battle of Hoth

- **ESA MERCURY (2009)** RF MEMS Based Reconfigurable Telecommunication Dual Reflector Antenna

- **EU COST Antenna Systems & Sensors for Information Society Technologies (ASSIST)**

- **EU COST Action IC0803 RF/Microwave Communication Subsystems for Emerging Wireless Technologies (RFCSET)**

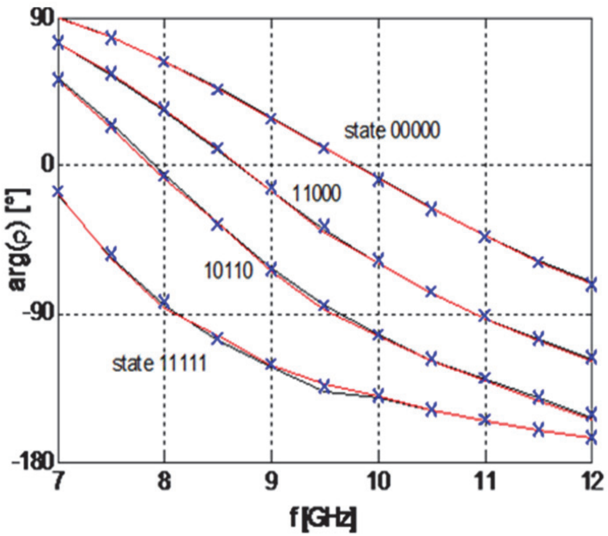
Research

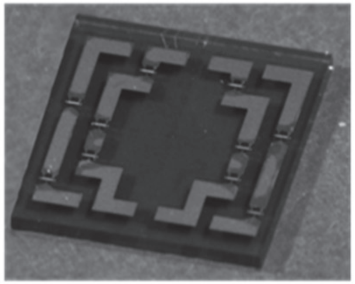
- **Publications (2008 - 2012):**
- Publications: 43 (Google scholar)
- 7 Transactions (4 as first author)
- 12 Letters (5 as first author)

- **Research Collaborations:**
- EPFL – Switzerland (particle swarm optimizer (PSO))
- METU – Turkey (MEMS technology)
- University of Zagreb – Croatia (co-supervision of PhD thesis)

Research

- **Reconfigurable reflecting antenna cells**



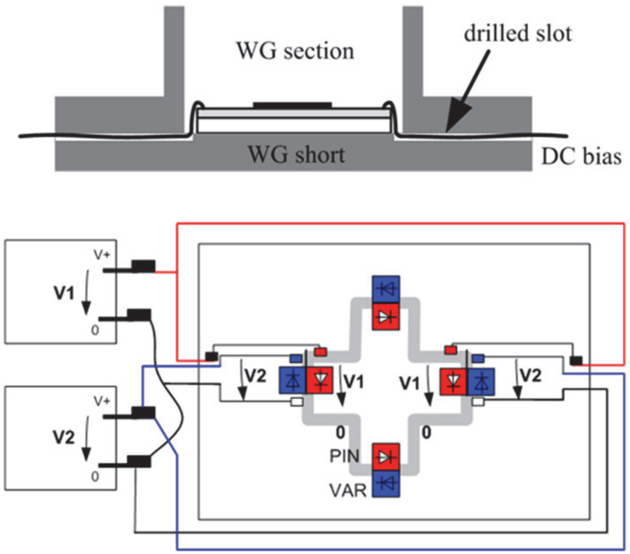


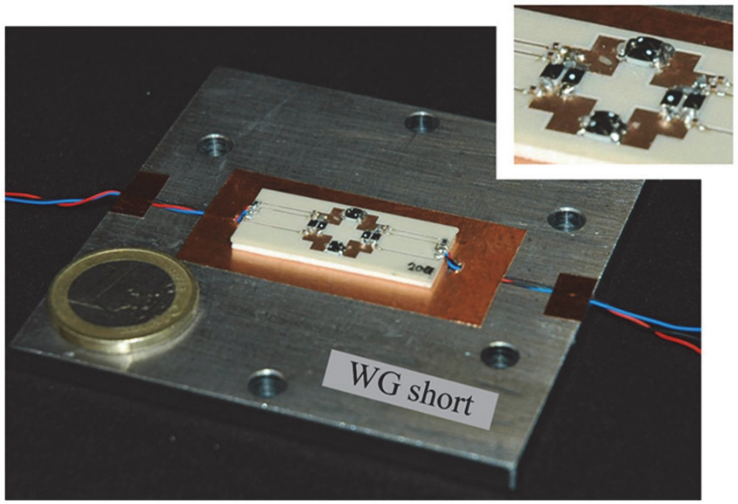
MEMS modeling	C.T. for 32 states
— Detailed geometry	5 days
— RLC boundaries	4 hours
× Internal ports	9 minutes

J. Perruisseau-Carrier, F. Bongard, R. Golubovic-Niciforovic, R. Torres-Sánchez, J.R. Mosig, "Contributions to the Modeling and Design of Reconfigurable Reflecting Cells Embedding Discrete Control Elements," *IEEE Transactions on Microwave Theory and Techniques*, vol. 58, no. 6, pp. 1621-1628, June 2010

Research

A reflecting cell offering dynamic and independent control of the reflection phase of two perpendicular linearly polarized waves.

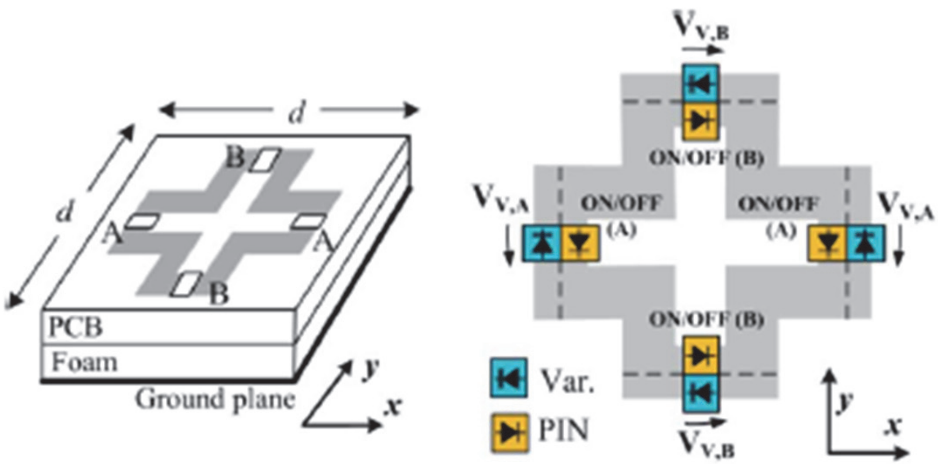


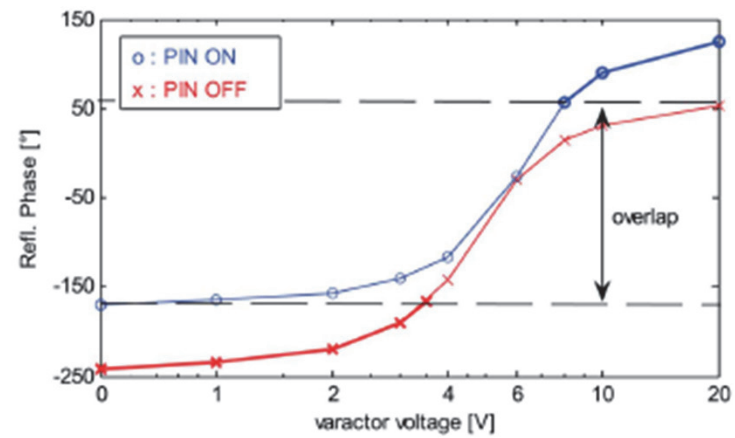


J. Perruisseau-Carrier, "Dual-Polarized and Polarization-Flexible Reflective Cells with Dynamic Phase Control," IEEE Trans. Antennas Propag., vol. 58, no. 5, pp. 1494-1502, May 2010.

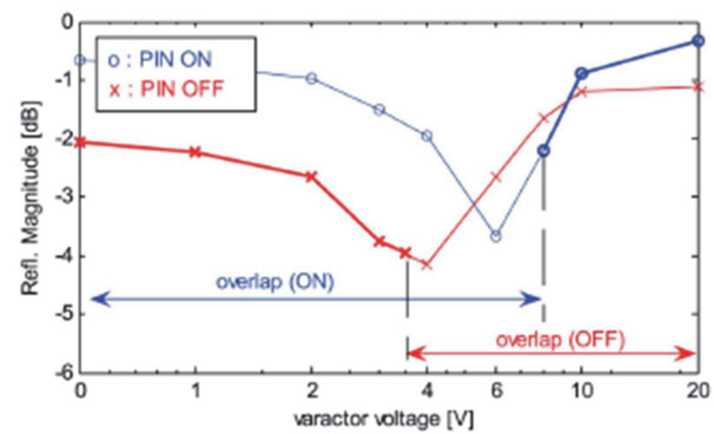
Research

- **Dual polarized and polarization flexible antenna cells**





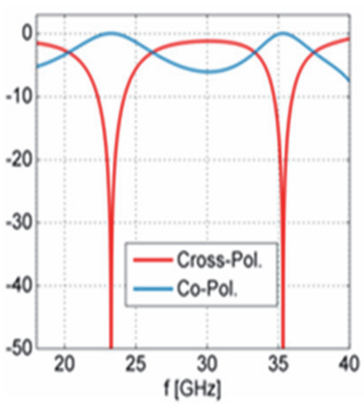
y-polarized incident wave:
Elements “A” control the reflection phase.
Elements “B” are placed in zeros of the current distribution.

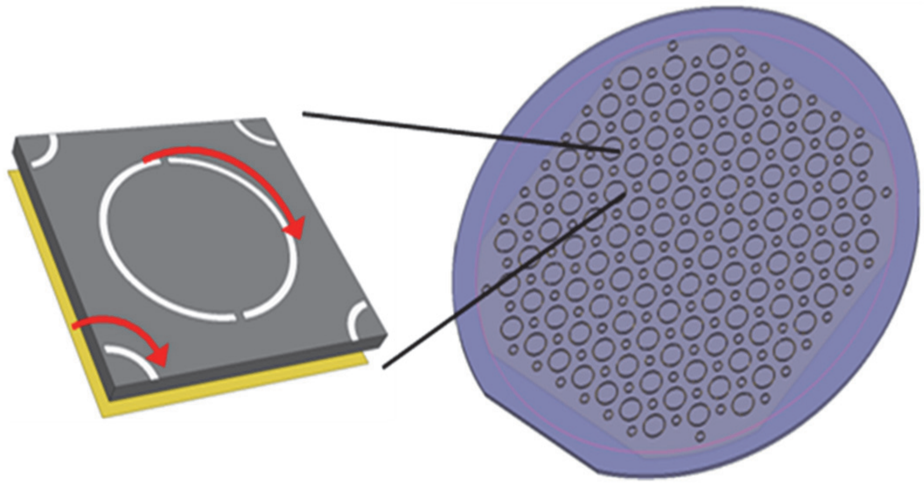


J. Perruisseau-Carrier, "Dual-Polarized and Polarization-Flexible Reflective Cells with Dynamic Phase Control," IEEE Trans. Antennas Propag., vol. 58, no. 5, pp. 1494-1502, May 2010.

Research

- **Dual-frequency MEMS-based circular polarized reflectarray**

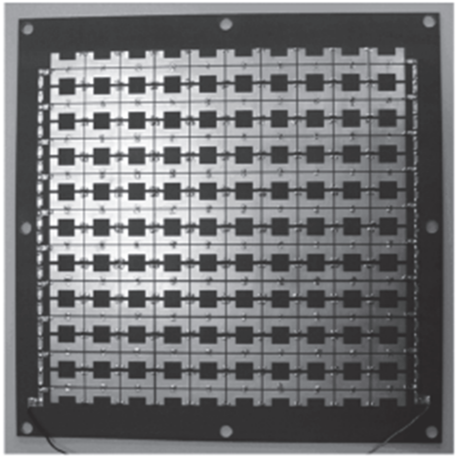


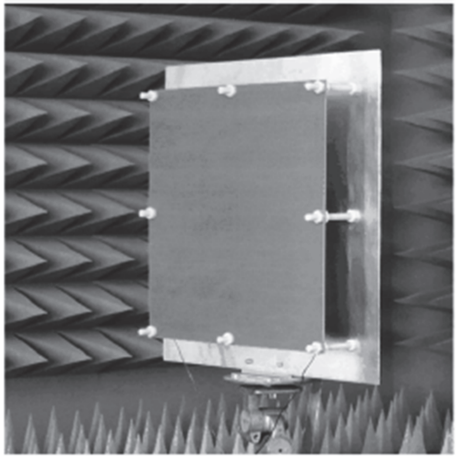


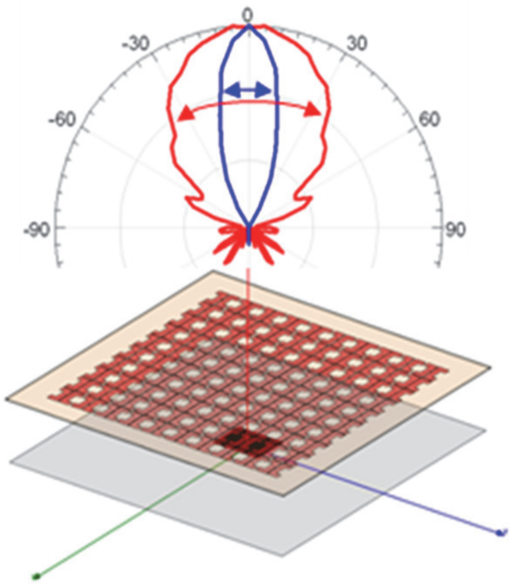
C. Guclu, J. Perruisseau-Carrier, and O. A. Civi, "Dual Frequency Reflectarray Cell Using Split-ring Elements with RF MEMS Switches" in IEEE International Symposium on Antennas and Propagation and USNC/URSI National Radio Science Meeting, Toronto, Canada, 2010.

Research

- **Partially-reflective uniform reflector for beamwidth-control**



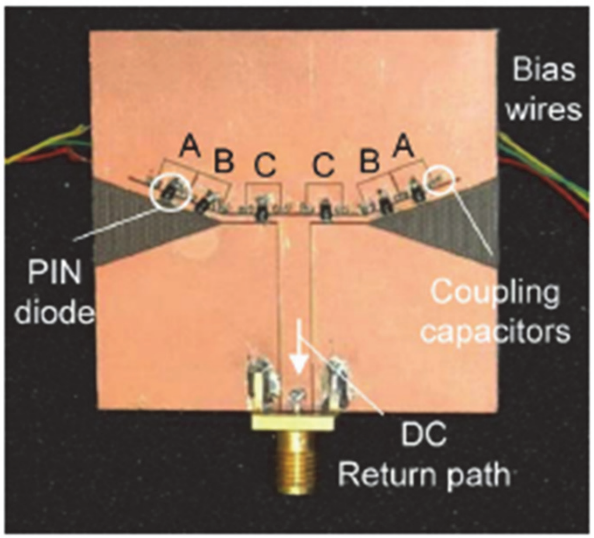


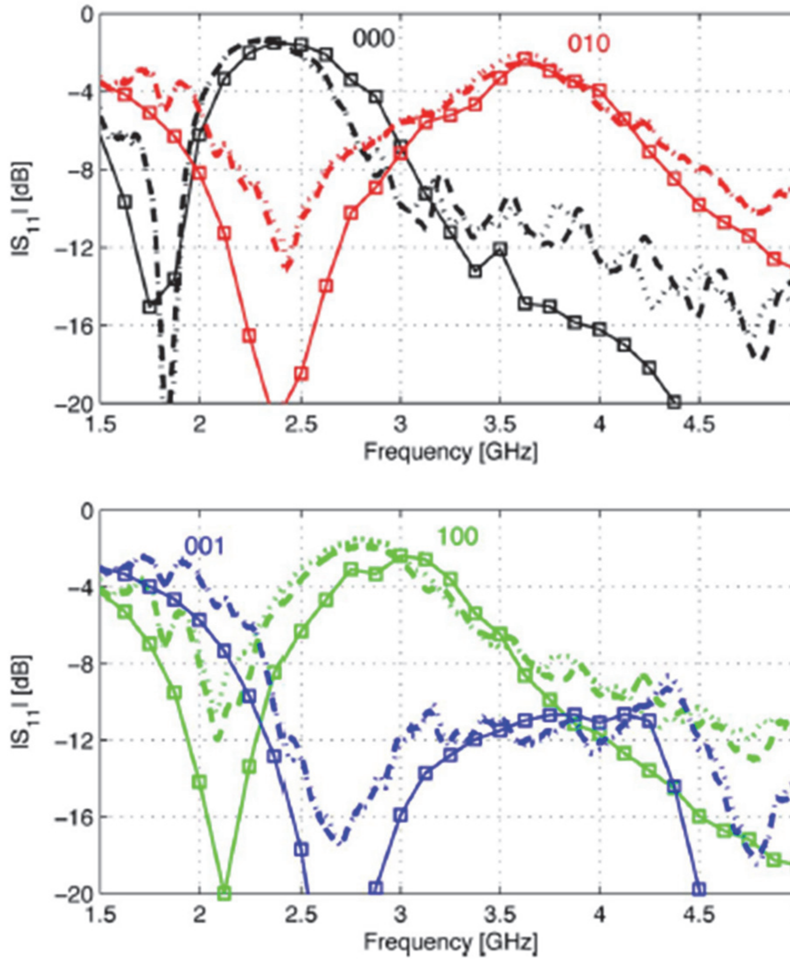


T. Debogovic, J. Perruisseau-Carrier, and J. Bartolic, Partially Reflective Surface Antenna with Dynamic Beamwidth Control, IEEE Antennas Wireless Propagation Letters, Jan. 2011.

Research

- **Wideband slot antenna with reconfigurable band rejection**

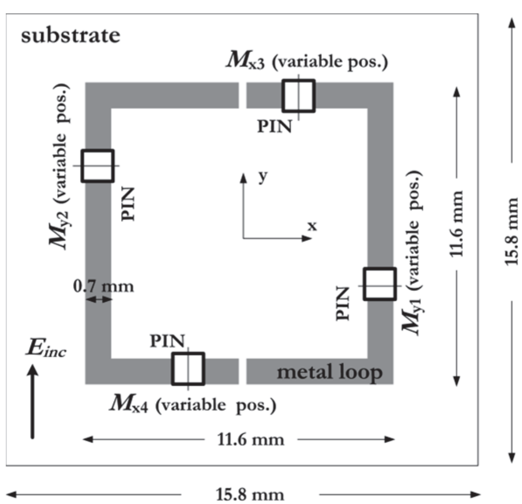


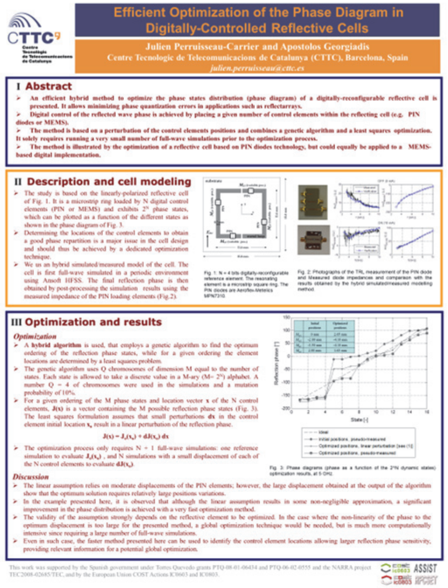


J. Perruisseau-Carrier, P. Pardo-Carrera, P. Miskovsky, "Modeling, Design and Characterization of a Very Wideband Slot Antenna With Reconfigurable Band Rejection," IEEE Transactions on Antennas and Propagation, vol.58, no.7, pp.2218-2226, July 2010.

Research

- Efficient Optimization of the Phase Diagram in Digitally-Controlled Reflective Cells
- **Two – tier algorithm**
- **Least-squares optimization and genetic optimization**

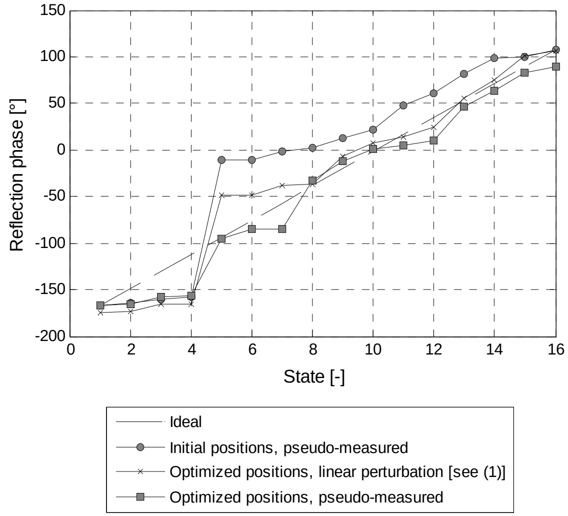




J. Perruisseau-Carrier, A. Georgiadis, "Efficient optimization of the phase diagram in digitally-controlled reflective cells," *Antennas and Propagation, 2009. EuCAP 2009. 3rd European Conference on* , vol., no., pp.1230,1233, 23-27 March 2009

Research

- **Two – tier algorithm**
- **Genetic algorithm**: ordering of the reflection phase states
- **Least squares**: element locations, assuming linear perturbation
- **N + 1 full-wave simulations**: 1 simulation to evaluate reference reflection phase Jo(xo) , and N simulations with a small displacement of each of the N control elements to evaluate dJ(xo).



J. Perruisseau-Carrier, A. Georgiadis, "Efficient optimization of the phase diagram in digitally-controlled reflective cells," *Antennas and Propagation, 2009. EuCAP 2009. 3rd European Conference on* , vol., no., pp.1230,1233, 23-27 March 2009

CTTC

- Office mates, Paolo Dini !

Julien and Friends

- Julien and friends, courtecy of Marco Miozzo