MultiWaveS

Multiband Electronically Reconfigurable Microwave Devices and Antennas for a New Generation of Wireless Systems

Call: FP7-PEOPLE-2009-IRSES
Duration: April 1 2010 – April 1 2013
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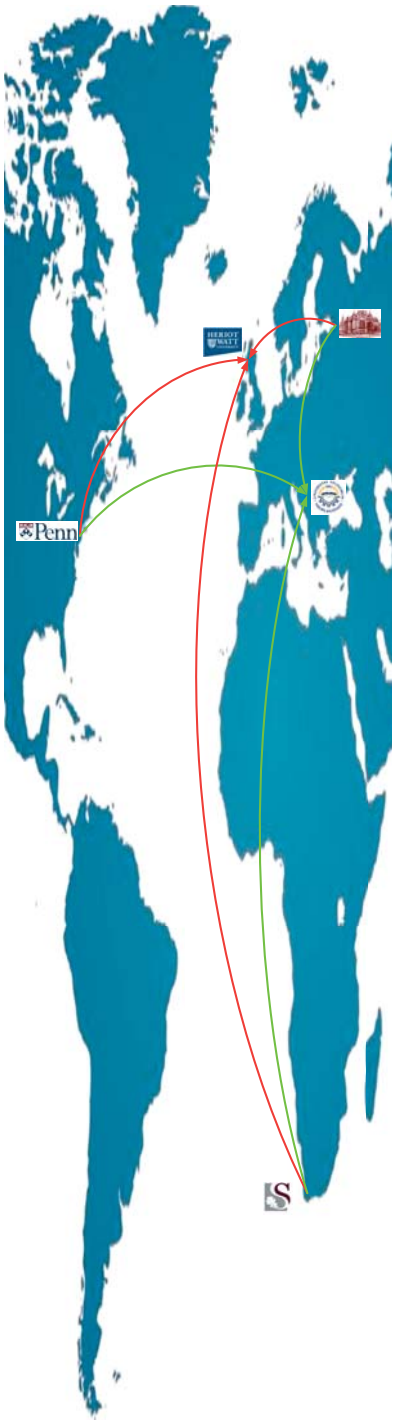
Partners:
Complementary expertise from 3 continents:

- University of Novi Sad, Faculty of Technical Sciences, Novi Sad, SERBIA
- Heriot-Watt University, Edinburgh, UNITED KINGDOM
- St. Petersburg Electrotechnical University LETI, St. Petersburg, RUSSIA
- Stellenbosch University, Stellenbosch, SOUTH AFRICA
- University of Pennsylvania Philadelphia, USA

Objective:
To expand the capacity of the participating institutions to progress in research, to communicate across disciplines, and to create a critical mass of researchers and knowledge needed for important scientific breakthroughs

Tools:

- A cohesive research- and education-oriented network in the interdisciplinary fields of advanced technologies, artificial EM materials, complex geometries, and application-oriented design
- A coordinated multiannual joint research programme between European and non-European research institutions.



Research challenge:
Wireless communications are omnipresent, yet frequencies are scarce.

Research approach:
Exploit complementarities and synergies between various technologies: conventional, ferroelectric, superconducting, fractal, metamaterial

Expected results:
Three main types of microwave devices redesigned for small size, improved functionality and multi-band operation: filters, antennas, and couplers and shifters.

Impact on ERA:

- Transfer of specific knowledge into Europe
- Reduction of fragmentation of research
- Inter- and intra-country cooperation
- Systematic and frequent reformulation of the problems
- Cohesive experimental and theoretical approach

Impact on the society as large:

- Experience of excellence
- Reward for complementarity
- Potential creation of new employments
- Inter-cultural exchange
- Gender balance

This project is funded by the European Commission; Marie Curie IRSES, contract number **PIRSES-GA-2009-247532**

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Filters:

Multi-band filters with independent control of central frequencies and corresponding bandwidths.

- Multi-band filters synthesis procedure
- Miniature multilayer LCP filters
- Near-zero metamaterial filters

Antennas:

High-gain, compact size, multi-band operation.

- Compact fractal antenna tolerant to folding
- Circular EBG wideband antenna
- EBG and NZ antenna with improved gain and directivity

Couplers:

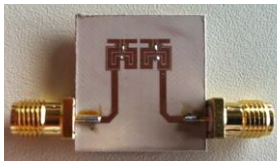
Ultra-compact size, excellent performances.

- Ultra-small couplers in LTCC technology
- Metamaterial and photonic crystal based solutions

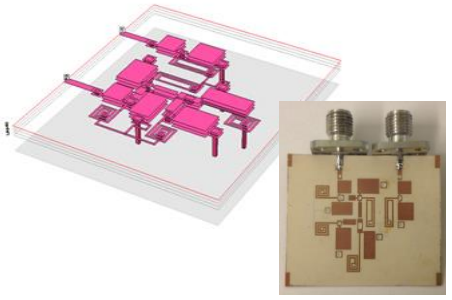
Other fields:

Breakthroughs in beyond those initially planned:

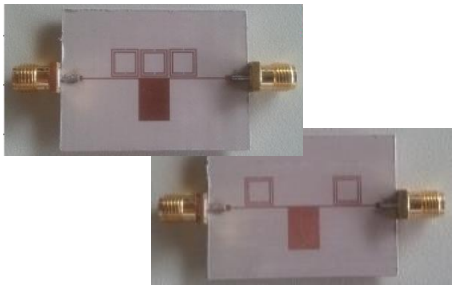
- Metatronics circuits
- Acoustic metamaterials and transformation acoustics
- Microfluidics
- Microwave sensors



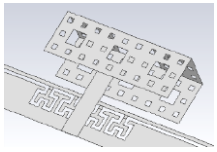
Most compact tri-band filters published up-to-date operating at 2.4/3.5/5.2 GHz:
- Excellent performances
- Excellent selectivity
- Independent control of the passbands

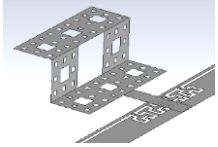


Miniature multilayer LCP bandpass filter:
- New design process
- 20 % fractional bandwidth
- Filter with size of only
  0.0294λg × 0.0303λg × 0.00052λg

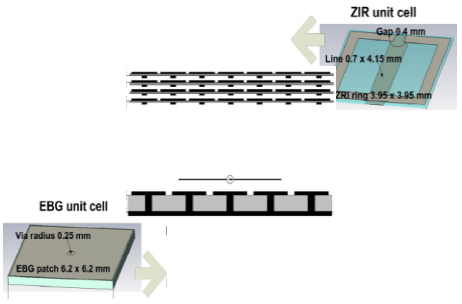


Novel class of near-zero metamaterial filters:
- Unusually small group delay and the variation of group delay
- Large potential for miniaturization

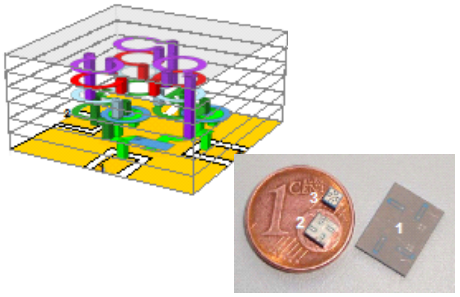




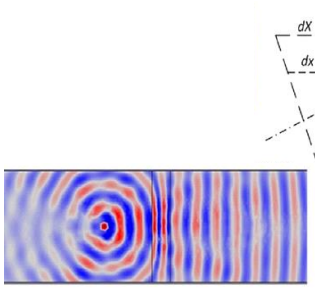
Flexible fractal antenna:
- Operates at UMTS range
- Tolerant to folding



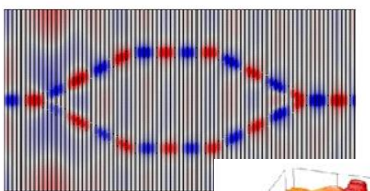
Using EBG and NZ effect to improve gain and directivity of conventional dipole patch antenna

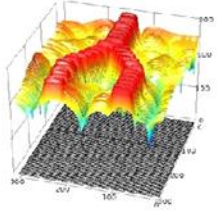


Ultra-small rat-race ring in LTCC technology:
- CPW architecture
- Overall dimensions < λg / 24

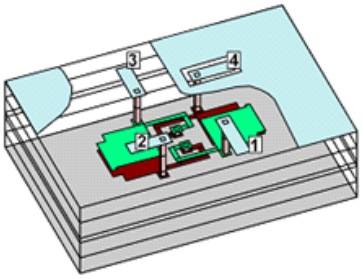


Breakthroughs in transformation acoustics:
- Acoustic GRIN medium





Breakthroughs in transformation acoustics:
- Acoustic Mach-Zehnder modulator



3-dB branch-line directional coupler in LTCC technology:
- Metamaterial-based
- Shifts the first spurious response an arbitrary frequency