IC1301 -WiPE

Wireless Power Transmission for Sustainable Electronics

Working Group 3: Novel Materials and Technologies

WIPE

COST IC1301

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EUROPEAN SCIENCE FOUNDATION

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EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY

Agenda

- Partners and Interests
- Research Topics
  - Materials
  - Technologies
- Collaboration tools
- Past and planned activities

Partners and Interests

- Hendrik Rogier, iMinds/Ghent University
  - Wearable, flexible and textile (active) antenna systemss
  - Body-centric communication
  - Electromagnetic Wave solvers
  - Substrate Integrated Waveguide Technology
- Maurizio Bozzi, University of Pavia, Italy
  - Flexible, textile and paper antennas
  - Electromagnetic Wave solvers
  - Substrate Integrated Waveguide Technology
- Paolo Arcioni, University of Pavia, Italy
  - Electromagnetic Wave solvers
  - Substrate Integrated Waveguide Technology
- Ana Collado, CTTC, Barcelona, Spain
  - Flexible and plastic antennas
  - Reflectarrays
  - Oscillators
  - Substrate Integrated Waveguide Technology

Partners and Interests

- Luca Roselli, University of Perugia, Italy
  - System on Paper
  - Wearable antennas
- Alessandra Costanzo University of Bologna, Italy
  - Fully fabrics-based multi-layer multi-band circularly polarized rectennas
  - Synthesis, characterization and measurements of magneto-dielectric substrates for miniaturized antenna systems
- Rafael Caldeirinha, Instituto de Telecomunicações (IT), Polytechnic Institute of Leiria (IPL), Portugal
  - Frequency selective surfaces (FSS);
  - Hybrid FSS and rectantenna design for wireless power harvesting;
  - Phase conjugated antenna array design;
  - Radio wave propagation modelling in complex environments (e.g. vegetation), including ray-tracing based models;
  - RF measurement systems (both for anechoic chamber 6m*5m*3m and outdoor environments) and channel sounder topologies.

Partners and Interests

- Motti Haridim, HIT, Israel
  - Wearable antennas
- Alex Takacs, University Paul Sabatier (Toulouse III), France
  - Co-simulation techniques for millimeter wave energy harvesters
  - Short Range Inductive Wireless Powering Systems for Automotive Applications
  - Graphene, nano RF?
- Zbynek Raida, Brno University of Technology, Czech Republic
  - Woven antennas (energy harvesting integrated to clothing)
  - On-body antennas (remote feeding of on-body sensors)
- Marco Antoniades – University of Cyprus
  - Antenna design and miniaturization, including active integrated antennas
  - Engineered electromagnetic materials such as negative-refractive-index metamaterials
  - Implantable and wearable antennas and devices for biomedical applications
  - Electromagnetic energy harvesting systems for wireless sensor networks and RFIDs
  - Non-radiative wireless power transfer systems

Partners and Interests

- Jasmin Grosinger, Graz University of Technology, Austria
  - Backscatter RFID sensor tag design
  - Body-centric backscatter communication; Wearable antennas
  - On-chip antennas; System in package
  - Booster antenna technology; Flexible antennas
  - RF measurement systems (anechoic chamber, automated wafer prober, channel measurements, etc.)
- Benoit Guiffard, Institute of Electronics and Telecommunications of Rennes (IETR), France
  - Ferroelectric/magnetoelectric thin films for RF energy harvesting
  - Electrostrictive polymer composite films for tunable soft printed antennas.
- Stepan Lucyszyn, Imperial College London, UK
  - Metamaterials
  - 3D printing

Partners and Interests

- Milos Mazanek, Czech Technical University , Czech Republic
  - Radiative (meta)materials
  - SIW and human body
- George Goussetis, Heriot-Watt University, Edinburgh, UK
  - Metamaterials
  - 3D printing
- George Stylios, Heriot-Watt University, Edinburgh, UK
  - textile antennas and on-body electronics http://www1.hw.ac.uk/sbc/RIFleX/research.html
- Mohamed Cheikh, Continental Automotive France SAS
  - Please specify?

Research Topics: Novel Materials

- Wearable WPT systems
  - Textile systems
- Implantable WPT systems
  - Biocompatible materials
- Flexible/conformable WPT systems
  - Plastics
- Recyclable/green WPT systems
  - Paper
- Low-cost/disposable WPT systems
  - Enhanced RFID tags

Research Topics: Novel Technologies

- Novel WPT topologies
  - Substrate Integrated Waveguide (SIW) technology
  - Novel active antenna topologies
  - Multi-antenna systems, reflectarrays
  - Metamaterials
- Novel CAD tools for WPT
  - Dedicated full-wave/circuit co-design and co-optimization
  - Dedicated propagation tools, integrated frameworks
    - Body-centric environments
    - Assessment of health effects
  - Material characterization procedures
- 3D printing
- Smart leaky waveguides
- Liquid crystals

Collaboration tools

- Short-Time Scientific Missions (STSM)
  - Prime tool to initiate collaboration by exchanging ESRs
  - STSMs to date
    1. Caroline Loss, “Electromagnetic characterization of textile materials for wearable antennas”, University Of Beira Interior, Covilhã to Ghent University, 2014-06-02 to 2014-06-30 and 2014-10-22 to 2014-11-22
    2. Catarina Isabel Alves Lopes, “New materials and fabrication techniques for the development of substrate integrat textile antennas”, University Of Beira Interior, Covilhã to Ghent University, 2014-10-22 to 2014-11-22
    3. Ali Albu-Rghaif, “RF testbed to prove GNSS signal receive algorithms”, University of Buckingham to Ghent University
    4. Maher Jassem, “RF testbed testing for multiplexed GNSS+Bluetooth signals”, University of Buckingham to Ghent University

Collaboration tools

- Bilateral Erasmus+ Proposals
  - Exchange of students, e.g. Master Thesis students
  - New agreements up to date
    1. Agreement University of Beira Interior (PT) and Ghent University (BE) signed, 2014
    2. Agreement University of Perugia (IT) and Ghent University (BE) signed, 2014
  - Master Thesis student exchanges up to date
    1. Lorenzo Silvestri, “Design of reconfigurable textile Substrate Integrated Waveguides”, University of Pavia to Ghent University, Academic Year 2013-2014
    2. Enrico Massoni, “Design of reconfigurable textile Substrate Integrated Textile Antennas”, University of Pavia to Ghent University, Academic Year 2014-2015

Collaboration tools

- Synergetic research
  - Combining novel materials with novel technologies
    - Textile/paper/plastic + SIW technology
      - Example: UGent+Univ. Pavia: textile + SIW
    - Novel active antennas based on carbon/ferromagnetic materials
    - Validating new CAD tools based on realistic examples
- Sharing measurement tools
  - VNAs, anechoic chambers, wireless testbeds
    - Example: Univ. Buckingham +UGent: GNSS receiver + wireless testbed
- Joint measurement campaigns
- Database of available materials and technologies

Collaborations tools

» Joint European Project applications

> Horizon 2020

> Proposals up to date

1. Dominique Schreurs (KU Leuven), Nuno Carvalho (Univ. Aveiro), Luca Roselli (Univ. Perugia, Hendrik Rogier (UGent), “In-Door Self-Adaptive Dual-Mode Wireless Powering, HOUSEPOWER”, proposal Horizon2020, FETOPEN-1-2014, not accepted

Collaboration tools

- Joint papers
  - Journal
    1. N. Carvalho, A. Georgiadis, A. Costanzo, H. Rogier, A. Collado, J. A. García, S. Lucyszyn, P. Mezzanotte, J. Kracek, D. Masotti, A. Boaventura, M. Nieves Ruíz, M. Pinuela, D. Yates, P. Mitcheson, M. Mazanek, and V. Pankrac, "Wireless Power Transmission: R&D Activities within Europe", IEEE Trans. Microwave Theory Tech. (IF 2.943, ranking 30/247, Q1, 2 citations), vol. 62, no. 4, pp. 1031–1045, Apr. 2014.
    2. R. Moro, S. Agneessens, H. Rogier, A. Dierck, and Maurizio Bozzi, "Textile Microwave Components in Substrate Integrated Waveguide Technology", IEEE Trans. Microwave Theory Tech., vol. 63, no. 2, pp. 422–432, Feb. 2015.
  - Conference
    1. A. Traille, S. Kim, A. Coustou, H. Aubert, M. Tentzeris, J. Kimionis, A. Georgiadis, A. Collado, 'Novel Inkjet Printed Modules for Sensing, Radar, and Energy Harvesting Applications,' in Proc. 2014 European Microwave Conference (EUMC), Rome, Italy, 5-10 Oct. 2014.
    2. J. Kimionis, A. Georgiadis, A. Collado, M. M. Tentzeris, 'Inkjet-Printed Reflection Amplifier for Increased Range Backscatter Radio,' in Proc. 2014 European Microwave Conference (EUMC), Rome, Italy, 5-10 Oct. 2014.
    3. M. Bozzi, F. Mira, A. Georgiadis, 'A Novel Multilayered SIW Filter with Two Mono-modal Cavities and Three Poles,' in Proc. 2014 European Microwave Conference (EUMC), Rome, Italy, 5-10 Oct. 2014.
    4. S. Rima, A. Georgi¬adis, A. Collado, R. Gonçalves, N.B. Carvalho, Passive UHF RFID Enabled Temperature Sensor Tag on Cork Substrate, in Proc 2014 IEEE RFID-TA, Tampere, Finland, 8-9 Sep. 2014.
    5. R. Goncalves, S. Rima, R. Magueta, A. Collado, P. Pinho, N. B. Carvalho and A. Georgiadis, 'RFID tags on cork stoppers for bottle identification,' in Proc. IEEE MTT-S IMS, Tampa, 1-6 June 2014.
    6. R. Moro, M. Bozzi, S. Agneessens, H. Rogier, "Compact Cavity-Backed Antenna on Textile in Substrate Integrated Waveguide (SIW) Technology", Proceedings of the 43rd European Microwave Conference, 4 pages, Nürnberg, Germany, Oct. 2013.
    7. S. Agneessens, H. Rogier, R. Moro, and M. Bozzi, "Robust, Wearable, On-Body Antenna Relying on Half Mode Substrate Integrated Waveguide Techniques", Proc. of the IEEE International Symposium on Antennas and Propagation, Memphis, Tennessee, USA, 2 pages, Jul. 2014. (Invited)
    8. S. Agneessens, S. Lemey, R. Moro, M. Bozzi, and H. Rogier. "The next generation textile antennas based on substrate integrated waveguide technology", 2014 XXXIth URSI General Assembly and Scientific Symposium (URSI GASS), 4 pages, Beijing, China, Aug. 2014. (Invited)
    9. Al-Aboodi, I. Lami, A. Albu-rghaif, P. Van Torre, H. Rogier, "A Single Acquisition Channel Receiver for GPS L1CA and L2C Signals Based on Orthogonal Signal Processing", ION GNSS+ conference, Tampa, Florida, Sep. 2015, submitted.

Collaboration tools

- Joint papers
  - Book Chapter
    1. C. Loss, R. Salvado, P. Pinho, S. Agneessens, H. Rogier, “Wearable Technologies: Dielectric Materials for Textile Antennas”, in "Research in Design, Management, Textiles and Fashion Technology", published by University of São Paulo (Brazil), ISBN 978-85-64842-13-7 (print), ISBN 978-85-64842-14-4 (online).
  - Award
    1. Honorable Mention, Student Paper Competition, 2014 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting, Memphis, Tennessee, USA. for “Robust, Wearable, On-body Antenna Relying on Half Mode Substrate Integrated Waveguide Techniques”, authors: Sam Agneessens, Hendrik Rogier, Riccardo Moro, Maurizio Bozzi

Past events

- EUCAP 2014 short course, Den Haag (NL)
  - Wearable Antenna Systems for Energy-Efficient Body-Centric Communication (lecturer H. Rogier)
  - **http://www.eucap2014.org/short-courses/Course%20Description%20-%20Rogier.pdf**
- NEMO 2014 conference, May 14-16, Pavia (IT)
  - Numerical EM Modeling and Optimization
  - **http://nemo-ieee.org/**
- PIERS 2014 Special Session, Guangzhou (China)
  - SC4: Novel Materials and Technologies for Microwave Components (M. Bozzi, H. Rogier)
  - **http://piers.org/piers2014Guangzhou/session.php?session_id=S051**

Upcoming events

- URSI AT-RASC 2015
  - General lecture “Energy-efficient textile antenna systems for body-centric communication and sensing”, Tuesday May 19, 2015, Lecturer: H. Rogier
  - **http://www.at-rasc.com/**
- URSI AT-RASC 2015
  - Special session S-AD “Wireless Power Transmission and Energy Harvesting (COST IC1301)”, May 2015, Organizers: P. Cruz, A. Georgiadis, H. Rogier
  - **http://www.at-rasc.com/**

STILL OPEN – Submissions requested urgently!!!

» Special issue, deadline TBD

> International Journal of Numerical Modelling (IJNM): Electronic Networks, Devices and Fields

> **Special Issue on Innovative modeling techniques for novel technologies in wireless power transfer**

> **http://onlinelibrary.wiley.com/doi/10.1002/jnm.1978/abstract**