



UNIVERSITÀ DI PISA
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE
Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

“Wireless power transfer: technologies and applications”

Alessandra Costanzo

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Short Abstract:

The course aim is to introduce the students to the analysis and design of entire systems able to provide EM energy wirelessly. Two different approaches will be presented: the first one is based on the reactive coupling between a transmitter and a receiver, by means of inductive or capacitive mechanism; the second one is based on radiative wireless power transfer and consists of active antennas at the transmitter side and rectenna (rectifying antennas) at the receiver side.

Different systems will be studied depending on the power level and on the operating frequency adopted for specific applications.

budget and how to select the proper WPT system, based on the application scenarios, to ensure the maximum system efficiency. The design of the following circuits, composing a WPT system will be studied:

- DC to RF converter, power generators
- Wireless links radiative and reactive
- RF to DC converter, rectifiers

Course Contents in brief:

DAY 1

- Introduction to energy autonomous and battery-less RF systems (1 h)
- A circuit-level unified approach to characterize the power budget of a whole WPT system (1 h)
- The Rectenna (rectifying antenna) design (3 h)

DAY 2

- The resonant inductive link (3 h)
- Electromagnetic/circuitual co-design (2 h)

DAY 3

- A Near-field WPT system for “on-the-move” recharging (3 h)
- A Far-field WPT system for energy-autonomous UWB localization (3 h)

Total # of hours: 16

References:

<https://www.unibo.it/sitoweb/alessandra.costanzo/publications>

CV of the Teacher:

Alessandra Costanzo is full Professor at the University of Bologna Cesena Campus, since September 2018. Her research interests are very widely distributed in the field of modern RF/microwave front-ends design, both traditional and miniaturized ones: specifically i) electro-thermal characterization and modeling of RF/microwave nonlinear devices; ii) development of simulation techniques for active microwave integrated circuits, including broadband self-oscillating systems, spanning electrical, stability, and noise performance; iii) nonlinear and electromagnetic co-simulation, co-design of active antenna systems, entire RF links, SISO or MIMO, including radiation and propagation specifications. In the last few years she exploited this background to provide highly innovative solutions for ubiquitous energy autonomous wireless embedded systems. She implemented highly innovative multi-band rectennas, specialized for wearable applications, for ambient RF harvesting and for micro-power generation to achieve energy autonomous sensor nodes. She studies and develops single-band and multi-band wireless power transmission systems (WPTs) and energy harvesting systems by adopting both near-field and far-field techniques, for different operating frequencies and different power levels. She also studies innovative hardware solutions for energy autonomous long-range UWB localization and system integration of simultaneous data and energy transfer.

She holds three international patents; she has authored or co-authored more than 170 papers in peer reviewed international conferences and journal and several chapters book.

She is IEEE Senior Member. She is past-chair of the MTT-S technical committee TC-26 “Wireless energy transfer and conversion”. She has been the co-founder of the EU COST Action IC1301(2013-2017) WiPE: “Wireless Power Transfer for sustainable Electronics” where she chaired the WG1 on “Far-field WPT” and was elected Italy member of the action management committee. She is steering committee chair of the new IEEE Journal of RFID and MTT-S representative on the CRFID. Since 2015 she has been Associate Editor of the *IEEE Transaction on Microwave Theory and Techniques* and of the *Cambridge Journal of Microwave and wireless technologies*.

Room and Schedule

Room: *Aula Riunioni, Dipartimento di Ingegneria dell'Informazione, Largo L. Lazzarino 1, 56122 Pisa, Edificio A, piano 6*

Schedule: 3 days in the first half of March 2020 (to be defined)