Rev. 2016-10-26

IMS2017 Student Design Competition Rules

As part of the technical program, the Student Design Competition (SDC) is one of the most energetic parts of IMS. The SDCs have proven to be very successful events in the past 12 years, as evidenced by the ever increasing student participation and the support it has enjoyed from the organizers, both logistically and financially. The IMS2017 in Honolulu will continue the legendary tradition of enthusiasm with a very strong SDC program.

TC number and name:

MTT-25 RF NANOTECHNOLOGY

The title of Student Design Competition:

Apps for Radio-Frequency Nanotechnology

Submission Deadline: Friday, 31 March 2017

Sponsors:

MTT-25 Radio-Frequency Nanotechnology

Primary contact name(s), email address, and phone number (of host or competition leader(s)):

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A short abstract or summary describing the competition:

The main motivation for application of nanotechology to electronics is to define new functionalities and new concept devices, beyond Moore, exploiting the unique features of nanostructured materials. For instance, a wide class of ballistic devices, e.g. mixers, RF detectors, sensors, antennas, logic circuits, can be modeled by account-

ing the wave nature of charge, with related phenomena at the meso-scale, e.g. tunneling, interference, spin effects, etc.

The goal of the competition is the development of compact educational computer-software, to introduce students to the concepts related to radiofrequency nanotechnology, by implemented examples and tutorials. This software should run on laptops and tablet computers and be based on Android, Apple iOS, Mac OS 10.x, or Windows, from 7.x to most recent platforms.

Design Specification/Rules:

While the advancement of research in Radio-Frequency Nanotechnology area heavily depends on the progress of manufacturing technology, still, the global modeling of multi-physics phenomena at the nanoscale is crucial to its development. Examples are given by modelling of quantum, thermal, electromagnetic, acoustic effects.

Modeling, of course, provides the appropriate basis for design. The bridge between nano-sciences and the realized circuits can be achieved by using the panoply of microwave/RF engineering methodologies at our disposal.

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Scope. A wide range of applications and topics are allowed. Field-based as well as network-based applications may be considered.

In order to provide some examples:

- modelling of devices based on the coupled system of Maxwell's and quantum transport equations,
- modelling of photonic crystals to enhance efficiency of thin Si solar cells,
- modelling and applications of surface plasmons in graphene and 2D materials,
- modelling of nanoantennas, or wireless optical power transfer between plasmonic nanoantennas
- modelling of nano-electromechanical structures,

- modelling of nano-thermocouples based on the Seebeck effect considering electro-magnetics and heat conduction,
- modelling of nano-optomechanical systems, moving boundaries, and phononic systems,
- near-field microscopy with nanometric or sub-nanometric resolution.

Evaluation Criteria:

1. Relevance to Microwave Field Theory and Techniques: How well does the app incorporate RF nanotechnology and/or RF nanoelectronics concepts into microwave engineering? Weight: 3
2. Educational Value: How well does the app teach/demonstrate a nanotechnology and/or RF nanoelectronics concepts, principles or phenomena? How well is it suited as educational tool for the design of RF nanotechnology and/or RF nanoelectronic devices or systems? Weight: 3
3. Graphical User Interface and Level of Sophistication: How intuitive and visually appealing is the interface and how effective is it in accommodating users of different levels of experience with the phenomena or method and the microwave principles involved? Weight: 2
4. Robustness and versatility of the app. Weight: 2

Prizes:

One level competition.

Primary member(s) of the team must be graduate student(s) enrolled in a University during the 2016-17 academic year. Undergraduate students may also participate as long as the team leaders are graduate students.

The winning team will receive a prize of $1000 (USD). There are two second places. The teams awarded the second place will receive a prize of $500 (USD) each.