Student Design Competition
for IMS2016 in San Francisco, CA 22-27 May 2016

Your TC number and name of your TC:
IEEE MTT-S TC 25: Radio-Frequency Nanotechnology

Primary contact name(s), email address, and phone number (of host or competition leader(s)):
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The title of your Student Design Competition:
Apps for Radio-Frequency Nanotechnology

A short abstract or summary describing the competition:
***Goal and competition objectives**: 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 as an executable file on laptops and/or tablet computers based on Mac OS 10.x, Windows, from 7.x to most recent platforms, Android, or Apple iOS. Alternatively, the software code and GUI may also be implemented in MatLab.
The software should be easy to install, easy to operate, and give the user insight into the respective topic. Primary focus of the developed tool should be its educational value.
***Motivation** 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 accounting the wave nature of charge, with related phenomena at the meso-scale, e.g. tunneling, interference, spin effects, etc.*
While the advancement of research in this 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 nanosciences and the realized circuits can be achieved by using the panoply of microwave/RF engineering methodologies at our disposal.

Which prizes will you offer and will this be a one level competition with all students combined or a two level contest so that undergraduates are judged separately from graduate students?
One level competition.
Maximum Number of Anticipated Awards: 3
The winning teams 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.

Brief description of competition and rule(s). Make this as long as you want.

Eligibility Criteria for Participating Students*: Primary member(s) of the team must be graduate student(s) enrolled in a University during the 2015-16 academic year. Undergraduate students may also participate as long as the team leaders are graduate students.*

Required Materials to be Submitted Prior to IMS 2016*: Intent to Participate Deadline: February 29, 2016. The intent must contain the app/program (executable codes) summary. This summary should state clearly the scope of the program and it should also summarize what the key features will be. An alpha version of the program can be submitted at this time if it is available.*

Space and Equipment Requirements*: Competing teams will use their own laptop or handheld device to demonstrate their apps. Competing teams must make their software tools (including installation instruction or respective App Store link) available to the Student Design Competition Adjudicators prior to demonstrating their softare tools at the conference.*

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 electromagnetics and heat conduction,*
- *modelling of nano-optomechanical systems, moving boundaries, and phononic systems,*
- *near-field microscopy with nanometric or sub-nanometric resolution.*

Judging Criteria*:*

a) Relevance to Microwave Field Theory and Techniques: How well does the software incorporate RF nanotechnology and/or RF nanoelectronics concepts into microwave engineering? Weight: 3

b) 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

c) Scientific relevance, breadth of content and originality. Weight: 2

d) 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