

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

Your TC number and name of your TC:

MTT-1 Computer Aided Design

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

Slawomir Koziel (koziel@ru.is)

Peter Aaen (paaen@ieee.org)

Jose Ernesto Rayas-Sanchez (erayas@iteso.mx)

Vikas Shilimkar (shilimkar@ieee.org)

The title of your Student Design Competition:

Computer-aided design of microwave passive circuits using novel optimization algorithms

A short abstract or summary describing the competition:

The goal of this competition is to stimulate ideas on computationally efficient optimization techniques for microwave passive circuits. Participants will be given three problems to solve. Each problem consists of a set of design requirements that the participants will be challenged with. The final designs will be tested using an electromagnetic simulation of the optimal structure. The evaluation of the teams will be based on the performance of the final designs, computational efficiency of the optimization algorithms, and novelty of the algorithms.

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?

Graduate students only

1st place: USD 1000

2nd place: USD 600

3rd place: USD 400

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

Purpose: *Popularization of CAD in general, with the emphasis on numerical modeling, simulation-driven design automation, and optimization methods.*

Format and requirements: *The competitors solve three simple optimization problems (2 to 3 designable parameters) listed below using their own developed algorithms or any other optimization methods of choice. Requirements:*

- *The structures have to be evaluated through full-wave EM analysis. Any commercial or custom EM simulation software can be used*
- *The usage of auxiliary equivalent circuits is allowed*
- *The starting point for each optimization problem will be arbitrary selected by the judges on the day of the competition*
- *Optimization codes and any other codes (e.g., EM solver interfaces) have to be developed in Matlab version 2013 or higher*
- *Novelty and key features of the algorithm and implementation aspects resulting in its computational efficiency need to be documented. Relevant references should be included*
- *Team entries are allowed but limited to two students per team.*

Assessment: *The competitors will be assessed based on:*

- *The quality of the final designs obtained*
- *Computational efficiency of the optimization algorithms*
- *Novelty of the algorithms*
- *Amount of user interaction required in the process*

Development of the own algorithm is preferred over utilization of the off-the-shelf algorithms.

*For a license of commercial EM software, contact its vendor. Sonnet Software agreed to provide a copy of the **em** software for the duration of the competition to those interested in participating. MathWorks will provide a complimentary license to each participating team in the IMS 2016 Competition. Contact the competition coordinators for more information.*

Problem 1

<i>Circuit</i>	<p><i>Impedance matching transformer</i></p>
<i>Substrate</i>	<p><i>Taconic RF-35: $h = 0.762$ mm (30 mils), $\epsilon_r = 3.5$, loss tangent = 0.0018, copper 1/2 oz/sq.ft. (18 μm thickness)</i></p>
<i>Design variables</i>	<p>$0.1 \text{ mm} \leq w_1 \leq 2.5 \text{ mm}$, $0.1 \text{ mm} \leq w_2 \leq 2.5 \text{ mm}$</p>
<i>Fixed variables</i>	<p>$w_{01} = 1.7 \text{ mm}$, $w_{02} = 0.41 \text{ mm}$, $l_0 = 5 \text{ mm}$, $l_1 = l_2 = 15.5 \text{ mm}$</p>
<i>Design specifications</i>	<p><i>Load impedance = 100 Ω and source impedance = 50 Ω</i></p> <p><i>Obtain at least (or better):</i></p> <ul style="list-style-type: none"> • $S_{11} \leq -20 \text{ dB}$ for 2 GHz to 4 GHz
<i>Typical responses</i>	<p><i>Initial (---) and close-to-optimal (—) responses</i></p>

Problem 2

<i>Circuit</i>	<p><i>Bandstop filter</i></p>
<i>Substrate</i>	<p><i>Taconic RF-35: $h = 0.762$ mm (30 mils), $\epsilon_r = 3.5$, loss tangent = 0.0018, copper 1/2 oz/sq.ft. (18 μm thickness)</i></p>
<i>Design variables</i>	<p>$12\text{ mm} \leq l_1 \leq 20\text{ mm}$, $12\text{ mm} \leq l_2 \leq 20\text{ mm}$, $12\text{ mm} \leq l_3 \leq 20\text{ mm}$</p>
<i>Fixed variables</i>	<p>$w_0 = 1.85\text{ mm}$, $w_1 = 0.5\text{ mm}$, $w_2 = 1.0\text{ mm}$, $l_0 = 5\text{ mm}$</p>
<i>Design specifications</i>	<p><i>Port impedance = 50 Ω</i></p> <p><i>Obtain at least (or better):</i></p> <ul style="list-style-type: none"> • $S_{21} \leq -30\text{ dB}$ for 2.2 GHz to 2.6 GHz • $S_{21} \geq -3\text{ dB}$ for 1.0 GHz to 1.6 GHz • $S_{21} \geq -3\text{ dB}$ for 3.0 GHz to 4.0 GHz
<i>Typical responses</i>	<p><i>Initial (- - -) and close-to-optimal (—) responses</i></p>

Problem 3

<i>Circuit</i>	<p><i>Bandpass filter</i></p>
<i>Substrate</i>	<p><i>Taconic RF-35: $h = 0.762$ mm (30 mils), $\epsilon_r = 3.5$, loss tangent = 0.0018, copper 1/2 oz/sq.ft. (18 μm thickness)</i></p>
<i>Design variables</i>	<p>$0.1 \text{ mm} \leq s_1 \leq 1 \text{ mm}$, $0.1 \text{ mm} \leq s_2 \leq 1 \text{ mm}$, $15 \text{ mm} \leq l_1 \leq 25 \text{ mm}$</p>
<i>Fixed variables</i>	<p>$w_0 = 1.7 \text{ mm}$, $w_1 = 0.7 \text{ mm}$, $l_0 = 5 \text{ mm}$</p>
<i>Design specifications</i>	<p><i>Port impedance = 50 Ω</i></p> <p><i>Obtain at least (or better):</i></p> <ul style="list-style-type: none"> • $S_{11} \leq -20 \text{ dB}$ for 2.24 GHz to 2.56 GHz • $S_{11} \geq -3 \text{ dB}$ for 1.0 GHz to 1.7 GHz • $S_{11} \geq -3 \text{ dB}$ for 3.1 GHz to 4.0 GHz
<i>Typical responses</i>	<p><i>Initial (---) and close-to-optimal (—) responses</i></p>