Organized by the Industrial Microwave Modeling Group (IMMG),
Center for Industrial Mathematics & Statistics (CIMS),
Department of Mathematical Sciences,
Worcester Polytechnic Institute, Worcester, MA, USA

Co-organized by the Institute for Pulsed Power and Microwave Technology (IHM),
Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

In cooperation with Society for Industrial and Applied Mathematics (SIAM)

Multiphysics Models and Material Properties

Karlsruhe, Germany
May 12-13, 2014

16th Seminar
“Computer Modeling in Microwave Power Engineering”

Program & Proceedings
**SEMINAR PROGRAM**

**Monday, May 12, 2014**

8:15  Bus departs from Hotel Kübler to KIT Campus North

8:45-11:15  **Excursion to KIT Campus North, Karlsruhe Institute of Technology**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:45</td>
<td>Arrival to KIT Campus North, Eggenstein-Leopoldshafen</td>
</tr>
<tr>
<td>9:00</td>
<td>Tour over the bioliq® facility</td>
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<tr>
<td>10:00</td>
<td>Visit to the high power gyrotron test stand</td>
</tr>
<tr>
<td>10:30</td>
<td>Visit to the HEPHAISTOS Experimental Center</td>
</tr>
<tr>
<td>11:15</td>
<td>Arrival to the Seminar venue</td>
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</table>

11:15-11:45  **On-site registration: KIT Campus North, FTU (Building No 101), Seminar Room “Mittlerer Hoersaal”**

11:45-12:05  **Welcome & Opening remarks**

_**G. Link**, Seminar Vice-Chair, Local Organization
Karlsruhe Institute of Technology, Karlsruhe, Germany_

**Introduction to the Seminar**

_**V.V. Yakovlev**, Seminar Founder and Chair
Worcester Polytechnic Institute, Worcester, MA, USA_

12:05-13:00  **Lunch**

<table>
<thead>
<tr>
<th>Multiphysics Modeling Workshop</th>
<th>FTU, Mittlerer Hoersaal</th>
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<tr>
<td>Chair:</td>
<td>G. Link</td>
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</table>

13:00-13:50  **Multiphysics Simulations with COMSOL Multiphysics in Microwave Applications**

_**N. Strah**
COMSOL Multiphysics GmbH, Göttingen, Germany_

13:50-14:40  **Coupled Electromagnetic-Thermal Simulations with CST MPHYSICS STUDIO**

_**U. Becker**
CST, Darmstadt, Germany_
14:40-15:00  
**Coffee break**

15:00-15:50  
**Fast 3D FDTD Modelling Using EMPIRE**  
*A. Wien*  
IMST GmbH, Kamp-Lintfort, Germany

15:50-16:40  
**Virtual Prototyping of Microwave Heating Systems with QuickWave 2014 Multiphysics Software**  
*A. Raniszewski*  
Novel, Fast, and Affordable Measurement Techniques for Complex Permittivity of Materials at Microwave Frequencies  
*P. Korpas*  
QWED, Warsaw, Poland

<table>
<thead>
<tr>
<th>Industrial Session and Exhibition I</th>
<th>FTU, Mittlerer Hoersaal</th>
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<tbody>
<tr>
<td><strong>16:45-17:30</strong></td>
<td><strong>Flash Presentations</strong></td>
</tr>
<tr>
<td>COMSOL Multiphysics GmbH</td>
<td>16:45-17:00</td>
</tr>
<tr>
<td>CST</td>
<td>16:45-17:00</td>
</tr>
<tr>
<td>MKS Instruments - Alter Products</td>
<td>17:00-17:15</td>
</tr>
<tr>
<td>Muegge GmbH</td>
<td>17:15-17:30</td>
</tr>
<tr>
<td>Vötsch Industrietechnik GmbH</td>
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17:45-24:00  
**Seminar Banquet (Vinery Marienhof, Flemingen, Palatinate)**

17:45: Bus departure to Flemingen  
18:45: Vinery Marienhof  
23:00: Bus departure from Flemingen  
24:00: Arrival to Hotel Kübler, Karlsruhe

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**Tuesday, May 13, 2014**

8:30  
Bus departs from Hotel Kübler to KIT Campus North

<table>
<thead>
<tr>
<th>Session I:</th>
<th><strong>Multiphysics Modeling</strong></th>
<th>FTU, Mittlerer Hoersaal</th>
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<tbody>
<tr>
<td>Chair:</td>
<td><em>J. Jelonnek</em></td>
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</tbody>
</table>

9:00-9:20  
**FDTD Modeling of Microwave Heating of Spherical Ceria Particles and Examination of Three Microwave Cavities**  
*H. Hammoud*¹ ², *S. Vaucher*¹, and *F. Valdivieso*²  
¹ Swiss Federal Laboratories for Materials Science and Technology (EMPA), Thun, Switzerland  
² Laboratoire Georges Friedel CNRS UMR 5307, St-Etienne, France
9:20-9:40  A Drying and Thermoelastic Model of Fast Microwave Heating of Concrete
B. Lepers, G. Link, and J. Jelonnek
Karlsruhe Institute of Technology, Karlsruhe, Germany

9:40-10:00  Modeling of Microwave Heating of Ceramic Materials with Respect to Changes in Sample Size
A. Rosin and M. Willert-Porada
Chair of Materials Processing, University of Bayreuth, Bayreuth, Germany

10:00-10:20  Coffee break

<table>
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<tr>
<th>Session II: New Techniques of Math Modeling</th>
<th>FTU, Mittlerer Hoersaal</th>
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<tr>
<td>Chair: J. Catalá-Civera</td>
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</table>

10:20-10:40  Frequency-Dependent Complex Permittivity Reconstruction of Layered Diaphragm in a Rectangular Waveguide: Comparison with Experiment
Yu.G. Smirnov¹, Yu.V. Shestopalov², and E.D. Derevyanchuk³
¹ Penza State University, Penza, Russia
² University of Gävle, Gävle, Sweden

10:40-11:00  Goubau Line Revisited: Refined Properties of Surface Waves
Yu.V. Shestopalov¹ and E.A. Kuzmina²
¹ University of Gävle, Gävle, Sweden
² Moscow State Institute of Radio Engineering, Electronics, and Automation, Moscow, Russia

11:00-11:20  Scattering and Generation Properties on a Nonlinear Layer and Eigen-Modes of the Linearized Problems
L. Angermann¹ and V.V. Yatsyk²
¹ TU Clausthal, Clausthal-Zellerfeld, Germany
² Usikov Institute for Radiophysics and Electronics NASU, Kharkiv, Ukraine

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<thead>
<tr>
<th>Industrial Session and Exhibition II</th>
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11:25-12:10  Flash Presentations
COMSOL Multiphysics GmbH
11:25-11:40  N. Strah
CST
11:40-11:55  U. Becker
MKS Instruments - Alter Products
Muegge GmbH
Vötsch Industrietechnik GmbH

12:10-13:20  Lunch
### Session III

**Determination of Material Properties**

**Chair:** Yu. Shestopalov  
**FTU, Mittierer Hoersaal**

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Authors</th>
<th>Affiliations</th>
</tr>
</thead>
</table>
| 13:20-13:40 | Time- and Temperature-Dependent Dielectric Measurements of Thermosetting Resins | D. Prastiyanto$^{1,2}$, G. Link$^1$, U. Arnold$^1$, M. Thumm$^1$, and J. Jelonnek$^1$ | $^1$ Karlsruhe Institute of Technology, Karlsruhe, Germany  
$^2$ State University of Semarang, Indonesia |
| 13:40-14:00 | High Temperature Dielectric Measurements of Concrete with Cavity the Perturbation Method | S. Soldatov, M. Umminger, A. Heinzel, T. Kayser, G. Link, T. Seitz, S. Layer, and J. Jelonnek | Karlsruhe Institute of Technology, Karlsruhe, Germany; |
| 14:00-14:20 | Design and Development of a System for In-Situ Dielectric and Calorimetric Measurements during Microwave Curing of Resins | V. Ramopoulos, S. Soldatov, G. Link, T. Kayser, and J. Jelonnek | Karlsruhe Institute of Technology, Karlsruhe, Germany |
| 14:20-14:40 | Coffee break | | |

### Session IV

**Modeling Technologies**

**Chair:** A. Wein  
**FTU, Mittierer Hoersaal**

<table>
<thead>
<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>14:40-15:00</td>
<td>Advanced Temperature Control of Distributed Microwave Coupling Systems</td>
<td>Y. Sun, T. Kuehner, G. Link, T. Kayser, and J. Jelonnek</td>
<td>Karlsruhe Institute of Technology, Karlsruhe, Germany</td>
</tr>
<tr>
<td>15:00-15:20</td>
<td>Phase-Shift-Based Efficiency Optimization in Microwave Processing of Materials with Solid-State Sources</td>
<td>P. Korpas, M. Krysicki, and A. Wieckowski</td>
<td>Warsaw University of Technology, Warsaw, Poland</td>
</tr>
</tbody>
</table>
| 15:20-15:40 | SiC Joining by Microwave-Assisted Combustion Synthesis | R. Rosa$^1$, P. Veronesi$^1$, S. Han$^2$, V. Casalegno$^3$, M. Salvo$^3$,  
E. Colombini$^1$, M. Ferraris$^3$, and C. Leonelli$^1$ | $^1$ University of Modena and Reggio Emilia, Italy  
$^2$ Fuzhou University, China  
$^3$ Politecnico di Torino, Italy |
| 15:40-16:00 | Synthesis of Luminescent Nanoparticles of Rare-Earth Compounds Using Microwave-Hydrothermal Treatment | A. Vanetsev, E. Samsonova, A. Popov, K. Keevend, I. Sildos, and Yu. Orlovskii | University of Tartu, Tartu, Estonia |
16:10-16:40  The Role of Modeling in Designing Industrial Microwave Heating Systems  
L. Musiol  
Fricke and Mallah Microwave Technology GmbH, Peine, Germany

16:40-16:50  Photo session

16:50-17:30  General discussion. Best Student Paper Award. Concluding remarks

http://www.wpi.edu/+CIMS/IMMG/Seminars/