



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**

8:45 Arrival to KIT Campus North, Eggenstein-Leopoldshafen
9:00 Tour over the bioliq® facility
10:00 Visit to the high power gyrotron test stand
10:30 Visit to the HEPHAISTOS Experimental Center
11:15 Arrival to the Seminar venue

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**

Multiphysics Modeling Workshop	FTU, Mittlerer Hoersaal
Chair: <i>G. Link</i>	

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

Industrial Session and Exhibition I	FTU, Mittlerer Hoersaal
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|-------------|---|---------------------------------|
| 16:45-17:30 | | <u>Flash Presentations</u> |
| | COMSOL Multiphysics GmbH | |
| | CST | |
| | MKS Instruments - Alter Products | 16:45-17:00 <u>M. Garuti</u> |
| | Muegge GmbH | 17:00-17:15 <u>M. Reichmann</u> |
| | Vötsch Industrietechnik GmbH | 17:15-17:30 <u>S. Betz</u> |

- 17:45-24:00 **Seminar Banquet (Vinery Marienhof, Flemlingen, Palatinate)**

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

Tuesday, May 13, 2014

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

Session I:	<i>Multiphysics Modeling</i>	FTU, Mittlerer Hoersaal
Chair:	<i>J. Jelonek</i>	

- 9:00-9:20 **FDTD Modeling of Microwave Heating of Spherical Ceria Particles and Examination of Three Microwave Cavities**
H. Hammoud^{1,2}, S. Vaucher¹, and F. Valdivieso²
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*

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

- 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. Derevyanchuk¹
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

<i>Industrial Session and Exhibition II</i>	FTU, Mittlerer Hoersaal
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- 11:25-12:10
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|---|------------------------------|
| COMSOL Multiphysics GmbH | <u>Flash Presentations</u> |
| CST | 11:25-11:40 <u>N. Strah</u> |
| MKS Instruments - Alter Products | 11:40-11:55 <u>U. Becker</u> |
| Muegge GmbH | |
| Vötsch Industrietechnik GmbH | |
- 12:10-13:20 *Lunch*

Session III	<i>Determination of Material Properties</i>	FTU, Mittlerer Hoersaal
Chair:	<i>Yu. Shestopalov</i>	

- 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. Heinzl*, *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:	<i>Modeling Technologies</i>	FTU, Mittlerer Hoersaal
Chair:	<i>A. Wein</i>	

- 14:40-15:00 **Advanced Temperature Control of Distributed Microwave Coupling Systems**
Y. Sun, *T. Kuehner*, *G. Link*, *T. Kayser*, and *J. Jelonnek*
Karlsruhe Institute of Technology, Karlsruhe, Germany
- 15:00-15:20 **Phase-Shift-Based Efficiency Optimization in Microwave Processing of Materials with Solid-State Sources**
P. Korpas, *M. Krysicki*, and *A. Wieckowski*
Warsaw University of Technology, Warsaw, Poland
- 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

Session V: *Industrial Modeling*
Chair: *G. Link*

FTU, Mittlerer Hoersaal

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**

S E M I N A R W E B P A G E

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