



AMPERE NEWSLETTER

A newsletter devoted to RF & MW heating in the range 1 MHz to 20 GHz

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Romania set to stage the 11th Microwave & High Frequency Conference



by Professor Marius Silaghi
University of Oradea
Romania

It gives me great pleasure to host the next AMPERE International Conference during 3-6 September 2007 in Oradea in Romania. The conference will be held in the "Felix Spa" health and balneary resort situated near Oradea, which is a strong economic, social-political and cultural centre in the North-West of Romania.

Let me take this opportunity to briefly describe our unit at the University of ORADEA, where much research activity has been carried out in the field of non-telecommunication application of radiowaves such as microwaves since 1976. Although Oradea is where most of the microwave activity has been concentrated over the years, some minor research has also taken place at the National Institute for Laser, Plasma and Radiation Physics, University of Bucharest and at the University of Timisoara.

The group at the University of ORADEA consists of a large number of colleagues having highly specialized expertise. The research work covers a wide range of topics such as:

- Theory
- Mathematical modelling
- Applicator design and development
- Magnetron design and development

The equipment for experimental research and for carrying out feasibility studies includes:

- Laboratory ovens
- Laboratory oven for high temperature
- Laboratory set up for drying of thin films
- Equipment for development of magnetrons

Our group focuses on commercially driven innovative research for microwave and high frequency applications into agricultural, chemical and forest industry, food processing, waste recycling, pharmaceuticals manufacturing of computer and tele-communication components, development of automotive components fabrication of devices for biotechnology, physiotherapy and medicine. The team should provide environmental best practice when microwaves and high frequency are applied in industrial processing.

We use modelling techniques for design, development and optimizing processes that use

microwaves and high frequency in areas such as paper and wood products, processing food products and beverages (for example pasteurization and sterilization), ceramics and other industrial products, prevention and treatment of pollution. Other scientific research should concentrate on medical applications and novel areas such as chemistry, biochemistry and pharmacy.



Equipment for measurements and analysis at the microwave laboratory

Our aim is to provide a focal point of microwave and high frequency research in Romania and to create a contact forum for national and international collaboration.

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Editorial

As we are all aware the 11th Microwave and High Frequency Heating International Conference will be held in Romania. Prof Marius Silaghi describes the current microwave research activity and their longer term aims for international collaboration.

I am delighted to welcome Professor John Pearce to briefly describe his activities at the Process Energetics Laboratory at the Dept of Electrical and Computer Engineering at the University of Texas at Austin. Further, in this issue Tom Wendell of the Ferrite Co, well known for their microwave food tempering equipment, describes a new development involving high power generators for a variety of applications.

Finally, it is with great sadness to report the death in July of Andrzej W. Kraszewski in Crete. His colleague and friend, Stuart Nelson, has provided us with an obituary, which appears on page 4.

*Ricky Metaxas, Newsletter Editor
St John's College, Cambridge CB2 1TP, England, UK*

New High Power Generator System from Ferrite



by Tom Wendel
The Ferrite Company, Inc., USA

The Ferrite Company's traditional uses of industrial microwave power, such as bulk food tempering and bacon cooking, have been well served by the 75kW generator. Some newer applications, however, require much higher levels of power. While a tempering system uses two or 3 generators and a large bacon cooking line uses six to eight of the 75kW generators, some new drying applications, such as municipal waste-water sludge drying, can require twenty or thirty of these generators. As the number of generators increases, the installation cost of providing the electrical, water, and control inter-connections necessary to support them becomes a significant expense.

It was these larger drying applications that provided Ferrite engineers with the inspiration for the Getmax design. The Getmax is a one megawatt microwave generator that combines ten 100kW modules into a single forty-foot long shipping container. By putting the modules into a container, the designer is able to reduce overall system complexity and costs by combining the support systems necessary for each module, such as primary power, cooling air, and cooling water. In addition, the ten modules are pre-wired to an internal control box so that remote system control can easily be accomplished through an Ethernet/IP network. Instead of requiring hundreds of wiring inter-connections, the Getmax requires only the 480V 3-phase power connections, an Ethernet cable, and two safety interlock wires.



Fig.1 A Getmax system being lowered into position



Fig.2 The Getmax generators

The user gains another cost-saving feature from the Getmax container itself. In many larger installations it is necessary to provide a building to house the microwave generators. Because the Getmax is a modified, weather-tight, shipping container, the Getmax need not be placed in a building. It can be installed on a concrete foundation, pilings, or on the roof of an existing building. The 480V, 2000A, 3-phase electrical service can enter the Getmax container from the bottom, top, side, or end of the container. The Getmax internal switch gear distributes power from a 2000A main circuit breaker to branch circuits for each of the modules and for the other utilities contained inside the Getmax.

While system integration cost reduction was the primary design goal of the Getmax, reliable operation was also given top priority. The electrical system was designed so that each module can function independently and undesirable events, such as a magnetron overload or component failures, will not affect neighboring modules. The internal switchgear provides a stiff power interconnection system that reduces voltage sag when all modules are running. In addition, the control system provides a soft start feature for the high-voltage transformers to prevent the high inrush currents and voltage spikes that often accompany the startup of the high-voltage transformers. The switchgear uses a transient voltage surge suppressor (TVSS) to absorb power line transients, including lightning, and to further reduce electrical noise within the Getmax system.

Careful consideration was also given to the selection of a programmable controller to use within the Getmax. While many of Ferrite's bacon systems have relied on Allen-Bradley's SLC-5/04 or SLC-5/05 series controllers, those controllers did not provide the speed or programming features that were considered desirable for the larger systems. Instead the Allen-Bradley Compact Logix system was selected for the job. One key advantage to the Compact Logix is that it provides operating speeds three to four times faster than the SLC processors. Another significant advantage is the new programming environment used for this processor, RS Logix 5000. This environment provides features such as data scoping, user-defined data types, and code modularity that are essential for a large, scalable control system.

Product Specifications:

Outer dimensions:	40 feet long x 8 feet wide x 9.5 feet tall (12.19m long x 2.44m wide x 2.90m tall)
Utility connections:	Electricity 480VAC, 3-phase, 1800 F.L.A. max. Water 100 gallons (378 litres) per minute at 70°F (21°C), Neutral pH, 50 micron maximum particle size. Air 250 cubic feet (7080 litres) per minute from surroundings, external filter provided on Getmax.
Outputs:	Ten (10) microwave ports of WR975, each supplying 100kW maximum microwave output at 915MHz frequency.
Controls:	Allen-Bradley Compact Logix PLC and Allen-Bradley PanelView Plus operator interface. Alternate controls available on request.



by John Pearce
The University of Texas at Austin
USA

The Process Energetics Laboratory in the Center for Energy and Environmental Resources at the University of Texas at Austin has been conducting studies of electromagnetic processing of industrial materials since 1988. The experiments have ranged from RF drying of zeolite greenware to induction fusion of graphite fiber composites to RF and microwave drying of pelletized dog food and other food products to regeneration of saturated VOC adsorbents to RF remediation of contaminated soils and microwave radiometry for temperature estimation. They also have some properties measurement capability at both RF and microwave frequencies in support of the experiments.

Microwave experimental apparatus at 2.45 GHz includes 500 W and 6 kW microwave multimode cavities and an adjustable 1.5 kW WR-284 waveguide applicator system. Radio frequency experimental apparatus includes 500 W capacitive and inductive bench test systems at 27.12 MHz and a 6 kW system at variable ISM frequencies. Ancillary measurement apparatus includes an Agilent 4194A Impedance Gain/Phase Analyzer (100 Hz to 100 MHz), an 8753C Network Analyzer (300 MHz to 3 GHz) and Thermometrics IR camera (covering the 3 to 12 μm wavelength band).

In some recent investigations researchers in the Laboratory have studied X-band microwave radiometry for temperature estimation and regeneration of carbon adsorbents. The activated carbon adsorbent problem is interesting because of their affinity for airborne water vapor. In humid climates the indigenous water vapor occupies adsorption sites decreasing the volume of volatile organic compounds that the adsorbent can collect. In general, microwave heating is not particularly well suited to regeneration owing to shallow penetration and adverse boundary condition problems. Radio frequency fields work well in this instance and exhibit some interesting physical principles at low water coverage: dielectrophoretic forces (net force on dipoles in strong E-field gradients) can dominate desorption of water, essentially without affecting adsorbed non-polar compounds.

Radiometric temperature estimation has the advantage over infrared optical methods in that it responds to elevated temperatures of heated materials inside of dielectric containers and from surfaces obscured by steam clouds, dust or other constituents in a harsh industrial environment. The method has been successfully applied in laboratory conditions involving steam (condensed water vapor) and inorganic airborne particulates. We have developed a radiometric temperature measurement instrument suitable for field tests, and have performed field trials at a cement plant and a food processing plant. In both cases, the radiometric instrument provided temperature data that is difficult or impossible to obtain by other non-contact methods.

Currently, ongoing projects include investigation of microwave radiometry for biomedical temperature applications and use of microwave power to produce plasmas with special properties. For more information contact the author at Dept of Electrical and Computer Engineering, The University of Texas at Austin, Austin, Texas, USA tel: + 1 512 4714984 or e-mail: editor@impi.org

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Microwave oven for high temperature heating tests

The Center will improve the international scientific and industrial competitiveness of Romania in microwave and high frequency technology. So far we have international collaboration with the following groups:

- Ghent University, Ghent, Belgium
- University of Bayreuth, Germany
- University of Cambridge, U.K.
- ENSEEIHT, Toulouse, France

Finally, I look forward to welcoming you to Oradea for AMPERE 11, where the local organising Committee, in close consultation with the Committee of Management of AMPERE, will provide you with a rich programme of plenary and invited presentations as well as oral and poster presentations. Other activities, including a programme for the accompanied persons will be announced nearer the time.

For more information contact the author at
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e-mail: masilaghi@uoradea.ro

Fiber Optic Temperature Sensors

Advantages:

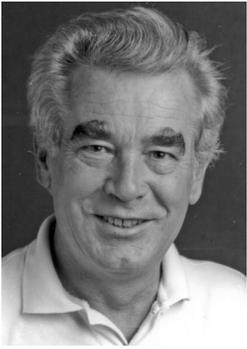
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Obituary: Dr. Andrzej W. Kraszewski



Dr. Andrzej Kraszewski died on July 2, 2006, in Iraklion, Crete, where he settled after retiring in 2001 as a Research Electronics Engineer with the Agricultural Research Service of the U. S. Department of Agriculture (USDA), Russell Research Center, Athens, Georgia, USA. He had a distinguished career of 48 years in research on microwave applications. Known to many scientists around the world as the founder of microwave aquametry, Dr. Kraszewski had worked with the USDA at Athens, for 14 years on research related to sensing moisture content in agricultural products through their microwave dielectric properties. His research is documented in more than 300 publications including several books and patents. It has provided the foundation for development of industrial microwave moisture meters. Scientists worldwide appreciate his work, and his publications are widely cited in the scientific and technical literature.

Dr. Kraszewski, born in Poznan, Poland, received the B.Sc. and M.Sc. degrees in electrical engineering from the Technical University of Warsaw, and the D.Sc. degree in technical sciences from the Polish Academy of Sciences, Warsaw. In 1953, he joined the Telecommunications Institute, Warsaw, where he conducted research and development on microwave systems and components. In 1963, he joined UNIPAN Scientific Instruments, a subsidiary of the Polish Academy of Sciences, as Head of the Microwave Laboratory. In 1972, he became the Manager of the Microwave Department of WILMER Instruments and Measurements, a subsidiary of the Polish Academy of Sciences in Warsaw, where he developed microwave instruments for moisture content measurement and control. Beginning in November 1980, he was a Visiting Professor at the University of Ottawa, Ontario, Canada, where he did research on RF and microwave dosimetry. In January 1987, he joined the USDA research effort at the Russell Research Center on dielectric properties measurements and moisture sensing in grain and other products by electromagnetic fields.

Dr. Kraszewski had been a member of Sigma Xi, the Institute of Electrical and Electronics Engineers (IEEE), the International Microwave Power Institute, the Materials Research Society, the New York Academy of Sciences, and the Polish Electricians Association (SEP). He was a guest editor and member of the editorial board for the Journal of Microwave Power and the IEEE Transactions on Microwave Theory and Techniques, and served as a reviewer and referee for these and many other journals. He organized the initial, second, and third international conferences on interaction of electromagnetic waves with water and moist substances. He received several professional awards, among them the State Prize in Science in Poland in 1980. In 1996, he was named a Fellow of the IEEE and recognized "for contributions to the science of microwave measurements and the development of microwave techniques for measuring water content in moist substances and permittivity, density, and mass of particulate dielectric materials."

Andrzej Kraszewski's contributions to microwave science and engineering were substantial and wide ranging. They included the development of microwave gas switching devices, microwave filters, duplexers, ferrite devices and other waveguide

components and measurement techniques for their evaluation. He was prominent in the development of measurement systems for the determination of dielectric properties of numerous moist materials such as margarine, fertilizers, grain, and cement slurries, and in the development of microwave instruments to facilitate industrial measurement of moisture content in these materials. He contributed to the development of measurement techniques for in-vivo and in-vitro permittivity measurements in various animal tissues and in materials simulating the properties of human tissues for dosimetry studies, which he carried out on full-scale models of the human body. He worked with dielectric mixture equations and developed mathematical models for the permittivity of cereal grains. He studied microwave resonant cavities for application to sensing moisture content and mass of objects of uniform and arbitrary shapes. He developed free-space measurement techniques for the dielectric properties of cereal grains and oilseeds and evaluated the usefulness of density-independent microwave sensing of moisture content and bulk density for on-line monitoring of moisture content in grain and other particulate materials.

Andrzej Kraszewski will be missed by his many friends and professional associates who appreciated both his unusual technical ability and his pleasant and endearing character.

Stuart Nelson, USDA, Athens, USA

New High Power Generator System from Ferrite

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For all of its technical advantages, the Getmax is surprisingly easy to operate. A user interface in the control room section of the Getmax provides access to all of the operating controls, power control parameters, interlocks, and trouble-shooting diagnostics necessary to operate it. Operators will find that everything they need to do is accessible from a single screen on the user interface. The Getmax may connect with other control systems using the Ethernet/IP network. This network provides the communications and control necessary for a system powered by one or more Getmax generators. System integration can be performed by Ferrite control engineers or by the end user.

Even as this article goes to publication, work is already underway to upgrade the internal systems of the Getmax to support a 125kW magnetron raising the total system output to 1.25 megawatts. Future development work is planned to include the design of a "half-Getmax" system that will provide 500-600kW of microwave power in a single integrated package. As the cost of natural gas and fossil fuels continues to rise, the number of applications in which microwave heating provides a cost-effective solution will continue to increase. The combination of higher output magnetrons, faster control systems, and cost-conscious design means that the Getmax can provide the high levels of microwave output required for today's power-intensive applications at a lower cost-per-kilowatt than has ever before been possible.

For more information, contact Tom Wendel, Project Engineer, The Ferrite Company, Inc., Nashua, NH 03060, USA

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News & Events

4th International Workshop on "Biological Effects of Electromagnetic Fields"

16-20 October 2006, Island of Crete
For more details please visit our web sites:
<http://imm.demokritos.gr/bioeffects> and
www.telecomlab.gr/bioeffects
additional information contact:
Ms Ketty Apostolou Workshop Secretary

WORKSHOP on Microwave Applications

16 November 2006, VITO, Mol, Belgium
This workshop, which will be conducted in Dutch and English,
is organised by VITO (G.Decat), RUG (Prof W. Van Loock) and
MEAC (C.Groffils).
For more information contact:
Prof. Dr. Ir. Walter Van Loock
Meerstraat 10, B-9270 Laarne, Belgium
Tel +32 9 369 66 54 Fax + 32 9 365 04 57
Email walter-van-loock@tiscalinet.be

Seminar on Hot Spots in the Microwave Field

23 November 2006
Campden & Chorleywood Food Research Association (CCFRA)
Chipping Campden, Gloucestershire, UK
To register directly or for further information see
www.campden.co.uk
Tel: +44(0)1386 842104 (direct line to Training)
Email: training@campden.co.uk

Asia-Pacific Microwave Conference (APMC 2006)

The APMC 2006 will be held during December 12-15, 2006 at
Pacifico Yokohama, Yokohama, Japan.
It is sponsored by the Institute of Electronics, Information and
Communication Engineers (IEICE) of Japan and co-operatively
sponsored by: IEEE MTT-S, URSI, EuMA, IEEE MTT-S Japan
Chapter
For more information visit the web site
<http://www.apmc2006.org/>
Email mweapmc@io.ocn.ne.jp

11th International AMPERE Conference on Microwave and High Frequency Heating

3-6 September 2007
Oradea, Romania
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Your news and views are always welcome

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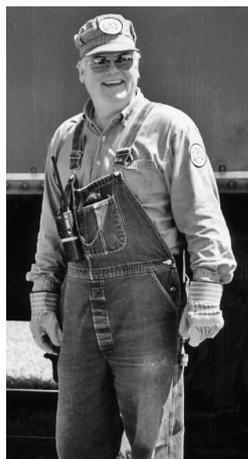
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Driving a Diesel LOCO for Fun!



Brakeman John Pearce

In this issue we featured the Process Energetics Lab at the University of Texas at Austin run by John Pearce who until recently was also the Editor-in-Chief of the Journal of Microwave Power and Electromagnetic Energy. What may not be that well known, however, is that John is also a certified diesel locomotive engineer on the Austin & Texas Central RR tourist railroad. The trip runs 33 miles one way and the train carries a maximum of 465 passengers in nine full sized (85 foot) standard gauge coaches and lounge cars on the round trip. The photo alongside shows John as a brakeman in front of one of the red coaches in the background.

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