理工学研究所
国際交流・公開研究セミナー

Jan Vrba 博士（チェコ･チェコ工科大学教授）が来日される機会に，電波科学の重要な一分野である医療電磁気学に関し，ご講演をお願いしました．是非ご参集ください．

題　目：　Prospective Applications of Microwaves in Medicine and Biology

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日　時：　2018 年 8 月 6 日（月）
15:30-16:30（講演時間帯が変更になりました）

場　所：　中央大学 後楽園キャンパス 6 号館 7 階 6701 号室

アブストラクト:

Interactions of EM field with biological systems are utilized in the area of therapy (oncology, physiotherapy, urology, etc.) from late seventieth of last century. Wide utilization of microwave thermotherapy can be observed in the countries of EU, USA, Russia, China, Japan and many others, including the Czech Republic. Important role in development in this area play scientific societies like e.g. ESHO (European Society for Hyperthermia Oncology), which co-operates with STM (Society for Thermal Medicine) and ASHO (Asian Society of Hyperthermia Oncology).

Nowadays the electromagnetic (EM) fields are generally used in several well-established medical applications already. Typical examples are e.g. Computer Tomography (CT) and Magnetic Resonance Imaging (MRI) in medical diagnostics as well as e.g. electro-surgery, radiofrequency (RF) heating in physiotherapy, microwave (MW) hyperthermia and RF + MW ablation in clinical therapy. Therapeutic applications of MWs, e.g. MW hyperthermia and ablation, are being used for the cancer treatment and treatment of some other diseases. In Prague e.g. in the Institute of Radiation Oncology and in the Proton Therapy Center in Prague.

To give a basic overview, we can divide the medical applications of microwaves in following three basic groups according to purpose, how are microwaves used:

- Treatment of patients (mostly on base of thermal or thermal effects of EM fields).
- Diagnostics of diseases (various kinds of microwave differential tomography based on permittivity measurements).
- “Only” a part of treatment or diagnostic system (microwave technology is not directly used for the treatment or diagnostics).

Until now most of medical applications of microwaves are above all represented by the treatment methods based on thermal effect, i.e. we can speak about the microwave thermotherapy, which can be further divided into three different modalities distinguished according to the goal temperature level or interval:

- Diathermia: heating up to 41 C (physiotherapy - treatment of rheumatic diseases).
- Hyperthermia: heating to the interval of 41-45 C (oncology).
- Thermoablation: over 45 C (urology - BPH treatment, cardilology - arrhythmia and fibrillations treatment).

Recent trends in microwave medical applications are to study the possibilities to develop new diagnostics based on EM field resp. on microwave technique. Main center of this research in the Czech Republic is at the Dept. of Biomedical Technique, Faculty of Biomedical Engineering of the Czech Technical University (CTU). A significant importance for the future can be identified for the next methods:

- Microwave differential tomography (stroke identification, brain stimulation, noninvasive temperature measurement),
- Microwave radiometry (tumor identification, noninvasive temperature measurement),
- Microwave diagnostic radar (noninvasive temperature measurement).

The use of MWs for medical diagnostics is relatively new but rapidly developing area. The main advantages of MW technology are as follows: MWs belong to a nonionizing radiation and for diagnostics purposes low power levels (1-20 mW) are used only. Furthermore, since the MW technology is being massively used in mobile telecommunication the MW diagnostic systems have potential to be one order of magnitude less expensive than MRI.

Last but not least – in our presentationwe would like to mention our activities in the area of the research of biological effects of EM Fields. Here we collaborate with Institute of Microbiology on the animal studies of the thermal effects of EM field. We did similar research with German Cancer Research Institute in Heidelberg, Germany. And as well we collaborate with the group from Dept. of Patophysiology on the animal studies of the influence of EM Field on Blood Brain Barrier.

講演終了後，懇談会を予定しております．

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