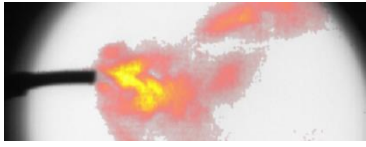




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name of the unit: INDUSTRIAL AND BIOMEDICAL APPLICATIONS OF INFRARED THERMOGRAPHY Institute of Electronics, Lodz University of Technology		symbol: I-23 http://www.eletel.p.lodz.pl
head of the unit: Prof. dr hab. inż. Paweł Strumiłło	potential promoters: Prof. dr hab. inż. Bogusław Więcek	contact person: tel: 48-42-631-26-37 boguslaw.wiecek@p.lodz.pl
scope of activities: The Institute of Electronics develops research in the field of industrial and biomedical applications of IR thermography. The work focuses mainly on the study of thermal phenomena occurring in electronic systems and energy systems, thermovision non-destructive testing, optical detection of gas leaks using the developed cameras as well as thermal imaging systems, and research in the field of multispectral thermography. These studies are carried out in cooperation with the industrial partners and other research centers. In addition, research and implementation of new methods and systems of medical thermography for diagnostics and screening are carried out. The research concerns new methods of image processing, in particular for applications in active dynamic thermography. The results of scientific work are new tools, systems and software, mainly for screening using the thermal stress method. An important area of research is thermal modeling of multilayer structures, including tissues, taking into account blood flow, anisotropy, modeling of thin and porous materials and non-Fourier heat transfer. Possible applications of the research results: 1. measurements of temperature, current and power of energy systems in varying environmental conditions 2. fiber optic systems for temperature and stress measurement (Raman spectroscopy), 3. systems of non-destructive testing of industrial objects - detection of delamination and damage, assessment of the condition of machines and devices, prediction of failures, 4. IR imaging systems for detecting people and objects in hazardous and explosive environments, 5. spectrometric systems for measuring the concentration of gases in industrial atmospheres, the composition of steel slag and the content of composite materials.		graphic material   
present activities: Measurements and spectral analysis of infrared radiation enables testing the properties of industrial objects. The research concerns the development of new methods of measuring radiation intensity and temperature with high sensitivity microbolometric sensors in the range of MWIR and LWIR 3-20 µm and InGaAs detectors in the range of NIR and SWIR 1-3 µm. The developed prototypes of measurement systems and software enable the implementation of new solutions. Innovative technical solutions are patented. The results of the research are new methods and prototype measurement systems for measuring temperature in industrial conditions, in an explosive atmosphere, systems for detecting defects,		



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assessing the condition of machines, for measuring stresses, atmosphere composition, for detecting people and other objects in foggy, smoky atmosphere and in the presence of poisonous and explosive gases.

Future activities:

Cooled cameras for non-destructive testing, cameras with a single sensor, photoacoustic sensors, distributed temperature measurement systems (Raman spectroscopy), modeling of multilayer industrial and biomedical structures, taking into account non-Fourier heat transfer.

Publications/patents, awards, projects:

1. Torzyk B., Więcek B., Second-Harmonic Contactless Method for Measurement of RMS Current Using a Standard Infrared Camera, IEEE Transactions on Instrumentation and Measurement, Published 2021, DOI:10.1109/TIM.2021.3077676
2. Kasikowski, R.S., Wiecek, B., Fringing-Effect Losses in Inductors by Thermal Modeling and Thermographic Measurements IEEE TRANSACTIONS ON POWER ELECTRONICS. Volume 36, Issue 9, Page 9772-9786, DOI 10.1109/TPEL.2021.3058961, Published, SEP 2021.
3. Strakowska M., Chatzipanagiotou P., De Mey G., Chatziathanasiou V., Wiecek B., Multilayer thermal object identification in frequency domain using IR thermography and vector fitting INTERNATIONAL JOURNAL OF CIRCUIT THEORY AND APPLICATIONS, Volume 48, Issue 9, Page 1523-1533, DOI 10.1002/cta.2845
4. Strakowski R.; Pacholski K., Wiecek B., et al., Estimation of FeO content in the steel slag using infrared imaging and artificial neural network, MEASUREMENT, vol. 117, pp. 380-389, 2018
5. Olbrycht R., Kaluza M., Wittchen W. et al., Gas identification and estimation of its concentration in a tube using thermographic camera with diffraction grating, QUANTITATIVE INFRARED THERMOGRAPHY JOURNAL vol. 15, no. 1, pp.2018, 106-120 .
6. B. Więcek, R. Olbrycht The method of elimination of thermal drift impact on image quality in microbolometer focal plane detectors, patent no. P.389303, 13.06.2013 r.
7. B. Więcek, R. Olbrycht, M. Kastek, T. Orzanowski, T. Sosnowski The method of correction of gain non-uniformity in microbolometer focal plane arrays, patent no. P.387173, 25.06.2013 r.
- B. Więcek, R. Strąkowski, M. Strąkowska, The method of thermovision camera calibration, patent P.218754, 2015.

Keywords:

Infrared thermography, non-destructive testing, active dynamic thermography, gas detection, thermal imaging system

List of internship proposal in this research team: