Research field: Measurement Techniques Development

Degree: MSc/PhD

Offer starting date: Immediately

Offer description: Advanced Multispectral Infrared Thermography

Please provide a paragraph describing the research topic:

Gas turbine engines heavily rely on the durability of hot-section components to achieve the required levels of performance, reliability, and safety. While high pressure turbines are exposed to gas path temperatures approaching their melting points, features such as cooling systems and environmental coatings are used in combination to meet design goals. The performance of these parts is critically dependent on the temperatures, cycles, time, and stresses achieved during engine operation. Thermometry systems offer nonintrusive optical temperature monitoring for hot-section diagnostics. However, their potential is currently hindered by poor absolute temperature accuracy (large error bounds), as a result of ill-characterized uncertainty sources. Modern applications attempt to circumvent this issue by empirical corrections (target specific calibration), which is particularly problematic for surfaces with low and varying emissivity, as encountered in most metals. Unlike most common monochromatic pyrometers, we are focusing our efforts on multi-spectral thermography of unknown emissivity surfaces. Although the emissivity is typically a function of both wavelength and temperature, on sufficiently close spectral bands, per-scenario assumptions (such as graybody, linear change with wavelength, etc.) are valid, and provide direct solution to the system matrix. By acquiring multi-integration time images and conducting quantitative image fusion considering total exposure non-linearity compensation, the currently developing optimized multispectral radiation thermography technique is geared towards accurate 2-D temperature measurement of hot target objects, absent of any repeated calibration. Thereby, directly decoupling surface temperature could contribute to significant advances in online monitoring of gas turbin

Requested profile (background and skills):

- A pre-existing solid background, or a strong desire to acquire knowledge, in the following subjects is essential: Advanced Measurement Techniques, Data Processing, Radiation Heat Transfer, Multiphysics Modelling.
- Expertise in MATLAB is a strong benefit.
- High level of English language proficiency is desirable.
- Candidates are expected to be self-motivated, hardworking and team players.

Application should be sent to: beni@cukurel.org

Your website: https://bcukurel.net.technion.ac.il/

Research field: Measurement Techniques Development

Degree: MSc/PhD

Offer starting date: Immediately

Offer description: Induction Phase Radiometry for TBC Properties Assessment

Please provide a paragraph describing the research topic:

Thermal barrier coatings (TBCs) are engineered to provide sustained thermal protection to engine components that are exposed to excessive heat load. In the wake of this application, a reliable, non-intrusive and quantitative thermal property measurement method is in high demand to assess the coating performance. Yet, the measurement of the thermal conductivity of thin ceramic coatings remains one of the most complicated problems in ceramic technology and thermal physics owing to the absence of precise methods to measure very small temperature differences between hot and cold surfaces of a specimen. The goal of our research is to create an in-situ method of assessing TBC properties using induction phase radiometry (provided the TBC is deposited over ferrous metal substrate). The method relies on application of induction heating element on the exposed surface of the TBC and measurement of the response using high frequency pyrometer.

Requested profile (background and skills):

- A pre-existing solid background, or a strong desire to acquire knowledge, in the following subjects is essential: Advanced Measurement Techniques, Data Processing, Radiation and Conduction Heat Transfer, Electro-Magnetism, Multiphysics Modelling.
- Expertise in MATLAB and LabView is a strong benefit.
- High level of English language proficiency is desirable.
- Candidates are expected to be self-motivated, hardworking and team players.

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Research field: Measurement Techniques Development

Degree: MSc/PhD

Offer starting date: Immediately

Offer description: Advanced Multi-Hotwire Anemometry

Please provide a paragraph describing the research topic:

In order to experimentally quantify aero-thermo-acoustic performance of work addition processes (such as fans), unique instrumentation is necessary to provide instantaneous velocity, density and temperature fields. Decoupling the effect of flow parameters on the sensor output signal is considered to be one of the historic challenges. In this regard, we are working on advanced 4-wire hot wire anemometry technique that is able to decouple such fluctuations from the mainstream flow processes. Experimentally characterizing the Nusselt-Reynolds relation over each wire in a simple calibration process, and accounting for the compressibility effects by semi-empirical Mach corrections, the heat transfer behavior of each thin heated filament can be accurately described. By deriving the sensitivity of each variable theoretically, we are able to attain a reasonably non-singular sensitivity matrix, formed by optimal selection of wire diameters and temperatures.

Requested profile (background and skills):

- A pre-existing solid background, or a strong desire to acquire knowledge, in the following subjects is essential: Advanced Measurement Techniques, Data Processing, Electronic Circuits, Convection Heat Transfer.
- Expertise in MATLAB and LabView is a strong benefit.
- High level of English language proficiency is desirable.
- Candidates are expected to be self-motivated, hardworking and team players.

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