Institute of Thermomechanics Seminar
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Lecture
No. 143

Institute of Thermomechanics, Czech Academy of Sciences

invites you to a lecture within the lecture series **Institute of Thermomechanics Seminar**

Laser Ultrasonic Non-Destructive Testing of Layered Structures: Imaging of Ply Waviness and Inspection of Adhesively Bonded Joints

prof. Łukasz Ambroziński,

Department of Robotics and Mechatronics
AGH University of Krakow (Poland)

Modern multilayer materials enable structures with unprecedented performance. Their safe operation requires non-destructive testing (NDT) methods that detect discontinuities at the interfaces between the constituent phases of a laminate and assess the arrangement of individual plies. For ultrasonic methods, this requires signals acquired over a wide frequency bandwidth.
This talk presents an ultrasonic NDT technique based on broadband, non-contact laser generation and fibre-optic interferometric detection of ultrasonic waves, operating in the thermoelastic regime without surface ablation. Results will be shown for imaging ply waviness (wrinkles) in carbon fibre-reinforced polymer (CFRP) composites, where individual plies are resolved and a correlation-based tilt filter maps the local ply angle as an indicator of wrinkle severity, and for multilayer aluminium plates bonded with epoxy film, with disbonds simulated by Teflon inserts. The physical principles will be discussed together with the signal processing developed to improve image quality.
Moreover, particular attention will be given to two complementary approaches to inspecting bonded joints. The first exploits zero-group-velocity (ZGV) Lamb modes, i.e. local plate resonances efficiently excited and detected by laser. Since different ZGV modes are sensitive to different bonding interfaces, tracking their frequency shifts allows disbonds to be imaged and the affected interface identified. The second uses laser-generated shear waves reflected from the disbond; with the source–receiver distance matched to the interface depth, it gives sharp images of the defect's lateral extent. Together, the approaches indicate which interface is damaged and map the defect geometry.

**The lecture will be held on Thursday, November 19th, 2026 at 10:00 a.m.
in the building of the Institute of Thermomechanics (in KLUB seminar room),
Dolejškova 5, 182 00 Prague 8**

Contact persons: Hanuš Seiner, Radek Kolman