UNIVERSITÉ LAVAL

Research Projects (M. Sc., Ph. D.) in *Infrared Vision*

The *Canada Research Chair in Infrared Vision* is seeking applicants at the M. Sc. and Ph.D. levels for various projects related to infrared vision (project scope will be adjusted depending of the degree sought: master or doctoral). The following projects are currently open:

1) INFRARED IMAGE PROCESSING IN THE FIELD OF AGRICULTURE. Infrared (IR) sensing can be applied with profit for non-contact temperature measurements of animals such as cows, chickens. This is particularly interesting for the early detection of possible disease(s) as well as other metabolic phenomena such as stress. Idea of the project is to follow temperature of several animals simultaneously. It is thus planned to mount the IR camera on a rail to survey the whole stable. In this project, students in robotics as well as in agriculture are involved.
We are seeking a student with interests and competencies in image processing, electronic, interfacing to complement this interdisciplinary team.

Infrared sensing can be applied to the Non Destructive Evaluation (NDE) of materials and structures, in this context it is called **Infrared NDE (IR-NDE)**. Basically, an external thermal stimulation is brought to the inspected component and response to this stimulus, recorded with an infrared camera, allows to determine the subsurface structure including the presence of potential subsurface defects such as delaminations, etc. Many problems arise in thermography either at the stimulation stage or at the signal interpretation stage. Projects "2, 3".

2) INFRARED NDE: STIMULATION/OBSERVATION STAGES. The objectives are to study in depth, through thermal modeling and experiments, the effects of various inspection stimulation schemes (pulsed, step, modulated heating) in order to enhance response from subsurface artifacts of interest. Aspects to consider: • *Robotic deployment* of a stimulation/observation head (an industrial partner is involved here). • *Alternative thermal stimulation* in IR-NDE including: Eddy currents and Ultrasonic thermal stimulation.

3) INFRARED NDE: INTERPRETATION STAGE. The objectives consist to pursue the development of advanced processing in order to extract signatures of the subsurface artifacts of interest including quantitative information (depth, size, thermal properties of those artifacts) enabling reliable automatic interpretation of data. Aspects to consider: • *Pulsed phase thermography* enhanced with wavelets to maintain access to the time information. • *Alternative Statistical Approaches* such as partial least squares regression, etc. • *Extension of these methods in 2D* (x-y on the specimen surface) instead of the traditional 1D (single point on the specimen surface). • *Fusion of information from different sensors* (Eddy currents and Ultrasonic thermal stimulation discussed above).

(2, 3): Projects will be specifically oriented towards one of the aspect discussed here. We are seeking for students with competencies and interests in image processing, NDE.

► For projects "2, 3": possibility of research stay in Belgium, Germany is offered (expenses paid).

► Requirements: M. Sc. degree for Ph.D. (or undergraduate degree for M.Sc.) in EE, ECE, (engineering) physics, material sciences, computer science. English competencies (French is a plus, especially for project 1).

► For all described projects: scholarships are offered, project starts as soon as the student position is filled.

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