METTI5 Tutorial T5 on

"Characterization of transient distributed surface sources through infrared thermography"

Authors: S. Vintrou^{1,2}, N. Laraqi¹, J.-G. Bauzin¹, A. Baïri¹

¹Université Paris 10, LTIE, EA 4415, GTE; 50 Rue de Sèvres, F92410 Ville d'Avray, France
²Ecole des Mines de Douai, Département Energétique Industrielle, 941 rue Charles, Bourseul, B.P. 10838, 59508 Douai Cedex, France
E-mails: vintrous@gmail.com and nlaragi@gmail.com

Duration: 1h30

Type: experimental and numerical

Content

During this workshop, we invite the participants to put into practice some of the fundamental notions seen during the courses dealing with the problem of spatio-temporal reconstruction of heat source. This course focuses on the estimation of spatial and temporal distributions of a given heat flux distribution received by the front face of a thin metallic plate from the temperature field collected on the back face of the sample by infrared thermal imaging. Measurements realized on the spot will allow to liven up the workshop. The collected data will be processed and then used in a code based on a sequential estimation method: the state representation "pseudo-inversion" of the 3D parabolic model of heat conduction phenomenon in the material. The heat flux density is made discrete in space (2D) and time. A good spatial and temporal resolution involves a high number of unknown values. The method not being iterative, the solutions are not auto-regularized by a stopping criterion. The high number of unknowns to be estimated simultaneously and the measurement noise increase the illposed character of this multi-dimensional inverse problem and regularisation tools are highly recommended in such situations. The optimization under constraints allows shading off these inherent instabilities. We suggest testing two regularizing techniques: (i) the stabilization by function specification proposed by Beck and (ii) the regularization by penalization developed by Tikhonov with three orders: 0, 1 and 2.



Experimental test bench (transportable)

Measured temperature (back)

Estimated heat flux (front)