

Eurotherm Seminar 94
Advanced Spring School: Thermal Measurements & Inverse Techniques
– 5th edition –
Station Biologique de ROSCOFF
June 13-18, 2011



Metti⁵

Proceedings of the 5th METTI School

The Eurotherm Advanced Spring School “Thermal Measurements and Inverse Techniques” has been run by the METTI Group (Mesures en Thermiques et Techniques Inverses) which constitutes a division of the Société Française de Thermique (French Heat Transfer Society). It was supported by CNRS, Université de Bretagne Sud and Université Européenne de Bretagne.

The METTI group has already run or co-organized four similar schools, in the Alps (Aussois) in 1995 and 2005, in the Pyrenees (Bolquère-Odeillo) in 1999 and in Rio de Janeiro, in cooperation with ABCM, Brazilian Society of Mechanical Engineering and Sciences, in November 2009.

For this fifth edition, which took place in Roscoff (Brittany, France), June 13-18, 2011, the school was again open to participants from the European Community with the support of the Eurotherm Committee. It gathered 75 attendees from 10 different countries, with one third of doctoral students.

This school, which was organized around modern generic methods of experimental design and inversion in heat transfer, is a consequence of the Eurotherm 68 seminar “Inverse Problems and Experimental Design” (Poitiers 2001) where participants felt the need for an up-to-date formation in these fields. It is also related to the cycles of “International Conference in Inverse Problems: Theory and Practice” and “Inverse Problems, Design and Optimization” (next IPDO Conference in Albi, France, June 26-28, 2013, see <http://ipdo2013.congres-scientifique.com/>).

Techniques for solving inverse problems as well as their applications are currently rapidly developing in all the different domains of physical sciences and particularly in heat transfer, applied mathematics, statistics, signal processing, etc.

Experimentalists desiring to go beyond traditional data processing techniques for estimating the parameters of a model with the maximum accuracy feel often ill-prepared in front of inverse techniques.

In order to avoid biases at different levels of this kind of involved task, it seems compulsory that specialists of measurement inversion techniques, modelling techniques and experimental techniques share a wide common culture and language. These exchanges are necessary to take into account the difficulties associated to all these fields. It is in this state of mind that this advanced school has been prepared.

Two books were distributed at the beginning of the school. Most of the corresponding files (texts and presentations), which have been revised with some modifications, can be freely downloaded now (see the Table below).

June 13, 2013

The organizing committee of the METTI School (SFT)

Stéphane André, Université de Lorraine
Jean-Luc Battaglia, ENSAM & Université de Bordeaux
Jean-Christophe Batsale, ENSAM & Université de Bordeaux
Yann Favennec, Université de Nantes (CNRS & organization)
Olivier Fudym, Ecole des Mines Albi & Université de Toulouse
Bertrand Garnier, Université de Nantes
Yvon Jarny, Université de Nantes
Najib Laraqi, Université de Paris X
François Lanzetta, Université Technologique Belfort-Montbéliard
Philippe Le Masson, Université de Bretagne Sud (finance & organization)
Christophe Le Niliot, Aix-Marseille Université (website & Eurotherm Committee)
Denis Maillet, Université de Lorraine (scientific coordination)
Daniel Petit, Université de Poitiers (Eurotherm Committee)
Fabrice Rigollet, Aix-Marseille Université
Jean-Jacques Serra, DGA, Odeillo
Joseph Virgone, INSA Lyon & Université de Lyon 1

10 Lectures with two of them (L5 and L9) decomposed in Part A and Part B

L1	L2	L3	L4	L5		L6	L7	L8	L9		L10
Getting started with problematic inversions	Basics for linear inversion, the white box case	Models and measurements for thermal systems, types of inverse problems	Non linear parameter estimation problems: tools for enhancing metrological objectives	Measurements with and without contact in heat transfer: principles, implementation and pitfalls		Time/space noise and « thermal processing » of temperature signal	Optimization methods for non linear estimation or function estimation	Experimental modelling through identification of low order models	Inverse problems		Linear Inverse Heat conduction problems - Two basic examples
				Part A Measurements with contact in heat transfer: principles, implementation and pitfalls	Part B Measurements without contact in heat transfer: principles, implementation and pitfalls				Part A Regularized solutions	Part B Thermal characterization of homogeneous and inhomogeneous materials using SVD techniques	
D. Maillet Y. Jarny D. Petit O. Fudym P. Le Masson	F. Rigollet O. Fudym D. Petit C. Le Niliot D. Maillet	D. Maillet D. Petit J.-L. Battaglia	B. Rémy A. André, D. Maillet	B. Garnier F. Lanzetta P. Le Masson J. Virgone	J.C. Krapez	J.C. Batsale C. Pradère	Y. Favennec P. Le Masson Y. Jarny	J.L. Battaglia	Y. Jarny	E. Palomo	Y. Jarny D. Maillet
Text-L1-Maillet.pdf	Text-L2-Rigollet-Fudym.pdf	Text-L3-Maillet-Petit-Battaglia.pdf	Text-L4-Remy-André.pdf	Text-L5A-Garnier-Lanzetta.pdf	Text: see ref. 1	Text-L6-Batsale.pdf	Text-L7-Favennec.pdf	Text-L8-Battaglia.pdf	Text-L9A-Jarny.pdf	Text: see ref. 2	Text-L10-Jarny.pdf
Presentation-L1-Maillet.pdf	Presentation-L2-Rigollet.pdf	Presentation-L3-Maillet-Petit-Battaglia.pdf	Presentation-L4-Remy.pdf	Presentation-L5A-Lanzetta&Garnier.pdf	Presentation-L5B-Krapez.pdf	Presentation-L6-Batsale.pdf	Presentation-L7-Favennec.pdf	Presentation-L8&T1-Battaglia.pdf	Presentation-L9A-Jarny.pdf	Presentation-L9B-Palomo.pdf	Presentation-L10-Jarny.pdf

References:

- Chapter 6, Radiative Measurements of Temperature, by J.-C. Krapez , pp. 185-232, in *Thermal Measurements and Inverse Techniques*, ed. H.R.B. Orlando, O. Fudym, D. Maillet, R.M. Cotta, CRC Press, Taylor & Francis
- Chapter 14, Karhunen-Loève Decomposition for Data, Noise, and Model Reduction in Inverse Problems, by E. Palomo del Barrio and J.-L. Dauvergne, pp. 507-540, in *Thermal Measurements and Inverse Techniques*, ed. H.R.B. Orlando, O. Fudym, D. Maillet, R.M. Cotta, CRC Press, Taylor & Francis Group, 2011

12 Tutorials

[illegible]

