

**EUROTHERM SEMINAR 60 Proceedings**

**Quantitative Infrared Thermography**

ISBN 83-87202-88-6

edited by: D. Balageas, G. Busse and G.M. Carlomagno

**Medical Infrared Thermography**

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# Quantitative Infrared Thermography, ISBN 83-87202-88-6

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## PREFACE

The continuous evolution of Quantitative Infrared Thermography (QIRT) techniques, systems, and fields of application is impressive. Nonetheless, making infrared thermography more and more quantitative is a permanent challenge for researchers, engineers, and physicians. To support them the Quantitative Infrared Conference was created in 1992 in the frame of the Eurotherm Seminars<sup>1</sup>. Since then, an International Working Group on QIRT (QIRT WG<sup>2</sup>) has been highly active. Its main actions consist in: choosing the group in charge of the next conference, selecting the papers, helping the local committees to organise the conference, selecting and reviewing the papers to be published in the proceedings. QIRT Conference was successively and successfully organised by the following institutions:

- The Thermophysics Division of the National French Aerospace Research Agency (Onera), which founded the conference by organising QIRT'92 at Châtenay-Malabry (France);
- The Department of Energetics, Thermo-fluid-dynamics and Environmental Control (DETEC) of the University "Federico II" of Naples, in charge of QIRT'94 held in Sorrento (Italy);
- The Institute for Polymer Testing and Polymer Science (IKP) of the University of Stuttgart (Germany), organiser of QIRT'96;
- The Institute of Electronics of the Technical University of Łódź (Poland), in charge of QIRT'98.

This list illustrates the international dissemination of quantitative infrared thermography in Europe. The Proceedings of the Conferences bear witness of the wide variety of the application fields. The regularity of the event - one conference every two years, in summer - proves the vitality of the field capable of generating a continuous flow of interesting and stimulating communications.

QIRT'98 was particularly important because two initiatives were undertaken:

- for the first time the conference moved from Western Europe to Central Europe,
- a noticeable importance was given to biomedical applications.

The first initiative was a justified recognition of the strong thermographic activity of the Polish scientific and industrial community. The QIRT WG wishes to thank Piotr Pręgowski, member of the WG until 1998, who proposed Poland as the nation in charge of organising QIRT'98 and Łódź as the conference site, and Bogusław Więcek, new Polish member of the WG, who took the charge of successfully organising the conference

The second novelty was the importance given to biomedical sessions. Taking into account the number of papers presented in this field (fourteen oral communications) and their specificity, the editors and the organiser of the conference decided to publish them in a special companion volume to the present proceedings: Medical InfraRed Thermography (MIRT'98).

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<sup>1</sup> The objective of the EURO THERM Seminars is to create within the European Community a forum for high-level scientific and technical interchange of ideas and developments in the thermal sciences and heat transfer, and their applications. This field is relevant to the challenges Europe faces: technological developments, energy resources and the solution of environmental problems. The primary aim of the seminars is to stimulate discussion and liaison between specialist groups.

<sup>2</sup> The present composition of the QIRT WG is the following : Darryl Almond (United Kingdom), Daniel Balageas (France) – chairman, Jean-Marie Buchlin (Belgium), Gerd Busse (Germany), Giovanni Maria Carlomagno (Italy), Xavier Maldague (Canada), Jukka Rantala (Finland), Srečko Svaic (Croatia), Vladimir Vavilov (Russia), Bogusław Więcek (Poland).

Consequently, the volumes MIRT'98 and QIRT'98 constitute the full proceedings of the Łódź conference.

The editors are grateful to the QIRT WG members, to the colleagues who presented the invited lectures, the oral presentations and posters, to those who chaired the sessions, and especially to the local group from the Institute of Electronics for the perfect organisation and the generous hospitality.

Finally, the Conference organisers acknowledge gratefully support by the following sponsors:

- the Polish State Committee for Scientific Research,
- the President of the City of Łódź,
- the Rector of the Technical University of Łódź,
- the Dean of the Electrotechnics and Electronics Faculty,
- Inframetrics Inc.

and to the companies which displayed their recent products in the exhibition, whose support made possible the attendance of many Central and East European participants.

D. Balageas, G. Busse, G.M. Carlomagno

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### PREFACE

The Eurotherm Committee was created in 1986 by members of the European Community to promote the European co-operation in Thermal Sciences by gathering thermal scientists and engineers working in specialised areas. The series of Eurotherm Seminars established by the Committee has become a popular forum for scientific and technical exchange of ideas on a wide range of special topics.

The continuous evolution of techniques, devices, and fields of applications is a permanent challenge for researchers and engineers working in the domain Quantitative InfraRed Thermography (QIRT). To make this development more effective, the QIRT Conference was established in the frame of the Eurotherm Seminars both to focus on recent achievements as well as to provide an opportunity for strong interchange between all specialists and potential users from various fields of applications. The first QIRT Conference was held in Chatenay-Malabry, in the Ecole Centrale de Paris in 1992 and chaired by Daniel Balageas.

During the course of the conference, the QIRT Working Group<sup>(\*)</sup> was established both for organisation of QIRT European Conference every two years, as well as for permanent information and co-ordination in the field of infrared thermography. The next conferences, QIRT'94 and QIRT'96, were chaired by Giovanni Carlomagno and Gerd Busse, and held in Sorrento (Italy) and Stuttgart (Germany). Every time the conference was preceded by three Pre-Seminar Courses on basic thermography, applications to solids, and applications to fluids.

The present conference QIRT'98 (Eurotherm Seminar No. 60) for the first time has been organised in Central Europe, in Poland, by the Institute of Electronics at the Technical University of Łódź. It was chaired by Daniel Balageas from ONERA France, and organised by Bogusław Więcek from TU Łódź.

A growing interest is now observed for medical applications of thermography, first of all because the thermography is a non-invasive way of diagnosis in medicine. The community of medical specialists using thermography and other infrared techniques is now significantly enlarging. In this context, and with the aim of enhancing the quantitative character of infrared thermography in all fields of application, and in particular in the medical one, the QIRT Working Group encouraged the participation of medical researchers in this conference.

During the present seminar, the session of medical applications was the largest during QIRT history, with 14 contributions, most of them presented by invited speakers. Although some papers of this session are not really dealing with quantitative aspects of the thermographic technique, the Working Group decided to publish the full collection of these papers and, to give more emphasis to this event, to publish them in a separate volume under the name of Medical Infrared Thermography – MIRT. The working Group wishes that the medical contributions to the next QIRT Conference will be enlarged and possibly more quantitative, since this character is the driving force and the *raison d'être* of the QIRT Conferences.

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<sup>(\*)</sup> The present composition of the QIRT-WG is the following: Darryl Almond, United Kingdom; Daniel Balageas, France; Jean-Marie Buchlin, Belgium; Gerd Busse, Germany; Giovanni Maria Carlomagno, Italy; Xavier Maldague, Canada; Jukka Rantala, Finland; Srecko Svaic, Croatia; Vladimir Vavilov, Russia; Bogusław Więcek, Poland.

The editors are grateful to the QIRT-WG members, especially to Scientific Committee, to all colleagues who presented the invited lectures, the oral presentations and posters, to those who chaired the conference sessions, and last but not least to the local group from the Institute of Electronics for perfect organisation and unlimited support. The organiser wishes to express many thanks to the sponsors of QIRT'98, and it is a great pleasure to acknowledge the helpful support provided by:

- the Polish State Committee for Scientific Research,
- the President of the City of Łódź,
- the Rector of Technical University of Łódź,
- the Dean of Electrotechnics and Electronics Faculty,
- Inframetrics Inc.

The conference organisers encouraged companies to display their recent product in the exhibition. The fees from the exhibition made the attendance of many Central and East European participants possible. It is a pleasure to acknowledge these companies for their indirect support which helped the organisers to bring together scientists and engineers working in quantitative infrared thermography.

D. Balageas, G. Busse, G.M. Carlomagno, and B. Więcek

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