Final Program

Time schedule for QIRT '96

QIRT 96 (Eurotherm Seminar No. 50) was hosted by:
IKP (Institut für Kunstoffprüfung und Kunststoffkunde)
Universität Stuttgart
Pfaffenwaldring 32
D-70569 Stuttgart (Vaihingen)

- Chairman: Professor Gerd Busse (IKP - Universität Stuttgart, Stuttgart, Germany)
- Co-Chairmen: Prof. G. M. Carlomagno (Universita di Napoli, Napoli, Italy)
- Co-Chairmen: Dr. D. Balageas (ONERA, Chatillon, France)

Dates: September 2 - 5, 1996

Monday Sept. 2nd

08.00 Registration for courses

Room B 09.00- 13.00
Course: *Basic Thermography* (X. Maldague, L. de Luca)
Room B 14.30- 17.30
Course: *Application to fluids* (G. Carlomagno)

Room C 14.30- 17.30
Course: *Applications to Solids* (G. Busse, D. Almond)

18.00-20.00 Registration for QIRT '96 and Welcome drink

Tuesday, Sept: 3rd morning

08.00 Registration

Room A

09.00

OPENING SESSION

Welcome addresses:
Prof. Dr.-Ing. Dr. h. c. mult. K. Stephan, Chairman of EUROTHERM
Prof. Dr.-Ing. G. Lechner, Vice president research Stuttgart University
Dr.-Ing. H.-J. Maier, MPA Stuttgart, Institute for material testing

Invited papers:
09.25- 10.05 *Thermography for nondestructive testing in civil engineering* (H. Wiggenhauser, BAM Berlin
10.05-10.45 *Infrared remote sensing from air and space* (H.P. Röser, DLR Berlin)

Coffee break

Room A

11.15- 12.30

SESSION A: TECHNIQUE AND SYSTEMS

Plenary session

- A1 11.15 - 11.40: D.Pajani, *High temperatures measurement, Choosing the spectral range. Measurement range, sensitivity and exactitude*
- A 2 11.40 - 12.05 : M. Martiny, R. Schiele, M. Gritsch, A. Schulz, S. Wittig, *In situ cali bration for quantitative infrared thermography*
- A 3 12.05- 12.30 : K. Chrzanowski, *Limitations of temperature measurement accuracy with thermal cameras*

2.30- 13.45 Lunch

Room A

13.45- 15.35

SESSION A: TECHNIQUE AND SYSTEMS

- A 4 13.45- 14.10 : P. Potet, *Thermal images based on MCT LWIR staring FPAs*
- A 5 14.10 - 14.35: J. Bolte, B. K. Bein, J. Pelzl, *IR detection of thermal waves-limitation by background radiation*
- A 6 14.35- 15.00 : L. Azizi, P. Herve, *Defect characterisation by means of thermographic imaging using lock-in detection method*
- A 7 15.00- 15.25 : P. Potet, *Lock -in therrnography using a long wave focal plane array camera applied to non-destructive testing of materials*

Posters:

- A8P: A. Russo, G. M. Piana, R. Marchesi, F. Cernuschi: *Characterization of spatial light distribution of flash lamp systems*
- A9P: S. Poloszyk, L. Rozanski, *Influence of the radiation diffraction in image converter of the thermograph upon its metrological parameters*
- A10P: V. A. Konovodchenko, L. D. Libkind, Y. A. Melenevsky, L. A. Nazarenko, *Metro logical complex for high sensitive detectors of IR radiation*
- A11P: G. A. Pjatnitskaja, A. V. Segen, A. K. Semennikov, S. B. Tihomirov, *Computerized thermovision complex for technical diagnostic and control*
- A12P: A. G. Zhukov, G.E. Grigoryev, E. V. Averin, E. P. Pugachev, A. V. Chekulayev, E. V. Plastikov, *Spectrum-analyzing thermal imaging system*
- A13P: P. Herve, A. Morel, *Thermography improvements using ultraviolet pyrometry*
- A14P: E.R. Meinders, Th.H. van der Meer, K. Hanjalic, C.J.M. Lasance, *Application of infrared image restoration to improve the accuracy of surface temperature measurements*

15.25- 16.00 Coffee break

16.00- 17.15

SESSION I: BUILDINGS, REMOTE SENSING, AND ENVIRONMENT

- I 1 16.00- 16.25 : J. Jaworski, *Estimation of heat losses from building wall*
- I 2 16.25- 16.50 : P. Pregowski, W. Swiderski, *Experimental determination of transmis sion of atmosphere-based on thermographic measurements*
- I 3 16.50 - 17.15 :D. Milovanovic, B. Wiecek, A. Marincic, G. Petrovic, Z. Barbaric, *Sta tistical analysis techniques for aerial infrared images in wavelets transform domain*

Posters:

- I4P :P. Pregowski, W. Swiderski, *Experimental data for prediction on thermal detection of underground objects*
- **I 5 P** E. Duc, Thermal measurement of the air tightness of the joints of building envelope components
- **1 6 P** S. A. Levchenko, Application of computer thermography for heat losses control in buildings

Room B 13.45- 15.35

SESSION D: THERMO-FLUID DYNAMICS

- **D 1** 13.45 - 14.10: A. llyinsky, Inverse conduction problems and quantitative infrared thermography
- **D 2** 14.10 - 14.35 G. Cardone, T. Astarita, G. M. Carlomagno, Heat transfer in a 150 deg turn channel for different heating conditions
- **D 3** 14.35 - 15.00 J. M. Buchlm, M. L. Riethmuller, R. Tasse, Convective heat transfer on slender cylinders
- **D4** 15.00 - 15.25 J. Dumoulin, M. Marchand, M. Plazanet, P. Millan, Heat transfer identi fication inducted by multiholes cooling in combustion chambers

15.25 - 16.00 Coffee break

16.00 - 17.15

Session F: APPLICATIONS AND SIZING EFFECTS

- **F1** 16.00- 16.25 : 0. Zogmal, Th. Lüthi, R. Primas, Factors affecting the detectability of voids by infrared thermography
- **F2** 16.25 - 16.50 : D. P. Almond, R. Hamzah, P. Delpech, M. Behesty, M. B. Saintey, Experimental investigations of defect sizing by transient thermography
- **F3** - 16.50 - 17.15: V Vavilov, T. Kauppinen, I Transient thermographic detection of bur ied defects: attempting to develop a prototype basic inspection procedure

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WEDNESDAY, SEPT. 4TH MORNING
08.00 Registration

Room A 09.00- 10.40

Session G: INDUSTRIAL PROCESSES

Plenary session

- **G 1** 09.00-09.25 : V. Ghiea, A. Colibaba-Evulet, Combustion graphology used to improve emulsions of water-in-heavy fuel oil
- **G 2** 09.25 - 09.50 : M. Laehdeniemi, A. Ekholm, 0. Santamaeki, Thermal imaging and fre quency analysis
- **G 3** 09.50 - 10.15 :P. G. Beradi, G. Cuccurullo, Velocity and thermal field thermography for thermoplastic polymers extrusion

- **G 4** 10.15 - 10.40: J. Vans, J. Tuominen, A. Autere, J. Rantala, Determination of glaze thickness on ceramic substrate using an infrared camera

10.40- 11.10 Coffee break

Room A 11.10- 12.25

Session E: CHARACTERISATION OF LAYERS AND COATINGS

- **E1** 11.10 - 11.35 : R. Ritter, B. Schmitz, Photothermal inspections of adhesion strengths and detection of delaminations
- **E2** 11.35 - 12.00 : G. Kalus, B. K. Ben, J. PeIzI, Characterization of tribological protective films and friction wear by IR radiometryof thermal waves
- **E3** 12.00- 12.25 : L. Kehoe, P. V. Kelly, G.M. Crean, Laser irradiated transient thermogra phy inspection of iron-zinc coatings on steel substrates

Posters:

- **E4 P:** A. Zagar-Maricic, IR-Thermography - a possible method for the non - destructive testing of protective coatings
- **E 5P**: R. Hüttner, T. Bahners, E. Schollmeier, The on-line detection of moisture and moist coatings by means of thermal waves
- **E 6P:** U. Netzelmann, H. Zhang, Applications of microthermography for coating and materials characterisation
- **E 7P :** B. K. Bein, G. Kalus, A. Mensing, V. Nueckel, Photothermal characterization of plasma-sprayed coatings
- **E8P**: T.T.N. Lan, H.G. Walther, Photothermal characterisation of surface hardened steel

WEDNESDAY, SEPT. 4TH MORNING

ROOM B 11.10- 12.25

SESSION H: MEDICINE AND BIOLOGY

- **H 8** 11.10 - 11.35 : V. Falk, T. Walther, T. Rauch, H. Kitzinger, F.W. Mohr, Thermal coro nary angiography for intraoperative evaluation of graft patency in coronary artery bypass surgery

- **H 2** 11.35 - 12.00 : J. Laszczynska, R. Kaczanowski, K. Wojcik, P. Sacha, J. Lukasiewicz, W. Kowalski, The human body skin surface distribution as measured by infrared thermog raphy in altitude hypoxia conditions
- **H 3** 12.00 - 12.25: A. Madrid, F. M. Kovacs, J. L. Madrid, G. Cebeira, Qantitative infrared thermography as a basic research tool to educate neurorelexotherapy mechanisms in humans

Posters:

- **H 4 P :** A. Madrid, F. M. Kovacs, J. L. Madrid, G. Cebeira Quantitative infrared thermog raphy as a basic research tool for the physico-mathematical modelling of thermoregulation in the human auricle
- **H 5 P :** A. Jung, J. Zuber, P. Sacha, J. Lukasiewicz, Thermovision monitoring of the tuber culin reaction in children
- **H 6 P :** A. Jung, J. Zuber, P. Sacha, J. Lukasiewicz, B. Kalicki, J. Rutka, Application of thermovision for monitoring of changes in kidney parenchyma after ESWL in children with nephrolithiasis
- **H 7 P:** D. Wu, H. Hamann, A. Salerno, G. Busse, Lockin-thermography for imaging of modulated flow in blood vessels

12.25- 13.45 Lunch

Wednesday, Sept. 4th afternoon

ROOM A 13.45 - 15.30

SESSION K: PRESENTATIONS OF EXHIBITORS

(Final program of this session will be available at the beginning of the conference)

15.30- 16.00 Coffee break
16.00- 17.15 Posters
All posters will be on display from Tuesday to Thursday. They are listed together with the ses sions. The intention of this separate poster session is to make sure that all poster authors are avail able for discussions at their posters during this time.
19.30 Conference dinner

Thursday, Sept. 5th morning

08.00 Registration

ROOM A 09.00- 10.40

SESSION G: INDUSTRIAL PROCESSES

- G 5 09.00-09.25: S. P. Gadaj, W. K. Nowacki, E. Pieczyska, *Investigation of temperature distribution during plastic deformation of stainless steel*
- G 6 09.25- 09.50 : 0. N. Budadin V. F. Panin, E. V. Abramova, *Working out and researches automated thermal NDT system applied, to internal defects inspection of sheet*
- G 7 09.50 - 10.15 : B. Frankovic, I. Samardic, B. Niceno, *Infrared thermography as a sup port for temperature distribution, determination during the welding process*
- G 8 10.15 - 10.40 : G. Bruggemann, J. Demus, Th. Benziger, *Simultaneous in-process con trol of weld pool geometry and heat affected zone based on thermal-optic imaging for welding by concentrated energy fluxes*

Posters:

- G 9 P: J. van der Stel, J. Wullink, *The application of thermal imaging in metals industry*
- GIO P : G.Walle, *Nondestructive characterization of the tendency to chilling in cast iron using pulsed video thermography*
- G 11 P: Okamoto, T. Inagaki, M. Sato, T. Kurokawa, *Detection of flashing temperature spots of dry friction interface by means of infrared radiometer*
- G 12 P: M. Safai, T.R. King, R.B. Greegor, *Thermal response measurements of aluminum and graphite epoxy due to irradiation by 256 MeV protons*
- G 13 P : W. G. Maslach, *Infrared technology protects people, products & productivity*

ROOM B 09.00- 10.15

SESSION 0: FLUIDS

- D 5 09.00-09.25: F. Boizumault, S. Harmand, B. Desmet, *Experimental determination of the local heat transfer coefficient on a thermally thick wall downstream of a backward-fac ing step*
- D 6 09.25-09.50 : S. Svaic, I. Sundov, *IR thermography and numerical methods, an inte grated tool for solving the heat transfer problems*
- D 7 09.50 - 10.15: G. Cardone, T. Astarita, G. M. Carlomagno, *Heat transfer measure ments in a rotating two-pass square channel by infrared thermography*

10.15 - 10.35 Coffeebreak

ROOM A 11.15- 12.25

SESSION D: FLUIDS

- D 8 11.10 - 11.35: R. Mayer, R. A. W. M. Henkes, J. L. van Ingen, *Wall-shear stress mea surement with IR-thermography*
- D 9 11.35- 12.00 : J. M. Buchlin, *Infrared thermography study of a confined impinging jet*
- D 10 12.00 - 12.25 : G. Cesini, V. Moro, R. Ricci, *A quantitative IR thermographic inves tigation of cooling of power electronic sources by forced convection cold plates*

Posters:

- D 11 P: V. Storozhenko, S. Melnik, *Computer technologies for thermal non destructive evaluation*
- D 12 P : C. Meola, G. M. Carlomagno, *Heat transfer in separated and reattached flow regions over a circular cylinder in a wind tunnel*
- D 13 P : R. Domanski, T. Wisniewski, M. Rebow, *Experimental study of natural convec tion in the melting of PCM in horizontal cylindrical annuli*
- D 14 P B. Wiecek, *Quantitative approach into heat exchange by convection in microelec tronics with thermography measurements*
- D 15 P M. Wandelt, W. Roetzel, *Lockin-thermography as a measurement technique in heat transfer*

ROOM B 10.45-12.25

SESSION C: ELECTROMAGNETIC FIELDS, STRESS EFFECTS AND CRACKS

- C 1 10.45 - 11.10 : J. Will, J. Norgard, C. Stubenrauch, K. MacReynolds, M. Seifert, R. Sega, *Infrared imaging techniques for the measurement of complex near-field antenna pat terns*
- C 2 11.10 -11.35 : D. Balageas, P. Levesque, M. Nacitas, J. C. Krapez, G. Gardette, *Micro waves interferometry revealed by photothermal films and lock-in IR thermography; appli cation to NDE of dielectric and radar absorbing materials*

- C 3 11.35 - 12.00: S. Offermann, C. Bissieux, J. L. Beaudoin, *Quantitative stress analysis by means of standard infrared thermographic equipment*
- C4 12.00 -2.25: J. Jouglar, M. Mergui, P. L. Vuillermoz, *Dynamical strain measurement by IRT*

12.25 - 13.45 Lunch

Thursday, Sept. 5th afternoon

ROOM A 13.45- 15.30

SESSION F: NDE: APPLICATIONS AND SIZING EFFECTS

- F 4 13.45 - 14.10 : J. Bolte, J. Pelzl, *Separation of optical and thermal properties and error limits in thermal depth profiling of fibre-reinforced materials*
- F 5 14.10- 14.35 : M. Reigl, G. Goch, *Finite-difference-method for depth-profiling of pho tothermal measurements*
- F 6 14.35 - 15.00: D. Wu, A. Salerno, U. Mater, R. Aoki, R. Kochendorfer, P. K. Kaechele, G.Busse, *Inspection of aircraft structural components using lock-in thermogra phy*
- F 7 15.00 - 15.25 : J. C. Krapez, G. Gardette, D. Balageas, *Thermal elipsometry in steady- state or by lock-in thermography: application for anisotropic materials characterization*

Posters:

- F8P : J. F. Pelletier, E. Grinzato, R. Dessi, X. Maldague, *Shape and uneven heating cor rection for NDT on cylinders by thermal methods*
- F9P: 0. N. Budadin, E. V. Abramova, V. F. Panin *Thermal tomography*
- F10P: E. V. Abramova 0. N. Budadin, *Thermal holographic defects measurement*
- F11P: D.Wu,C.Y.Wu,G.Busse, *Investigation of resolution in lock-in thermography: the ory and experiment*
- F12 P: I. Benko, G. Koteles, *Thermal imaging of the effects of beta-irradiation*

15.25- 16.00 Coffee break

ROOM B 13.45- 14.35

SESSION C: ELECTROMAGNETIC FIELDS, STRESS EFFECTS AND CRACKS

- C5 13.45- 14.10 : G. Kurilenko, *Infrared prediction of the crack resistance*
- C6 14.10 - 14.35 : 0. Schlicht, H.P. Wolfel, *Determination by time dependent crack con tact behaviour by thermoelastic stress analysis*

Posters:

- C7P: J. Geerkens, M. Reick, B. Schmitz, G. Goch, *Photothermal investigations on advanced ceramics*
- C8P: J. Vogel, J. Auersperg, W. Faust, M. Dost, B. Michel, *Experimental and numerical investigations of thermomechanical field coupling effects during crack evolution*

14.35 - 15.25

SESSION B: THERMOPHYSICAL PROPERTIES

- B1 14.35 - 15.00 : F. Cernuschi, A. Russo, G. M. Piana, V. Marcolongo, P. Mutti, L. Viv ian, *Emissivity measurements at room temperature on polymeric and inorganic samples*
- B 2 14.35 - 15.00: J.C.Batsale, D. Mourand, C. Gobbe, *Estimation of thermophysical properties of thin plates with averaging techniques and two temperatures model*

Posters:

- B3 P: H. Madura, H. Polakowski, B. Wiecek, *MWIR and LWIR emissivity meters*
- B4 P: H. Madura, H. Polakowski, B. Wiecek, *Spectral emissivity evaluation for material used in microelectronics*
- B5P: H. Madura, B. Wiecek, *Radiative heat exchange in microelectronics*

15.25 - 16.00 Coffee break .

Room A 16.00- 17.15

SESSION J: EMERGING TECHNIQUES

- J1 16.00 - 16.25 : X. Maldague, J.-P. Couturier, A. Salerno, D. Wu, *Advances in pulse phase thermography*
- J2 16.25 - 16.50: 0. Breitenstein, K. Iwig, I. Konovalov, D. Wu, *Lock-in contact thermog raphy on solar cells - comparison with IR- measurements*
- J3 16.50 - 17.15 : J. Rantala, D. Wu, A. Salerno, G. Busse, *Lockin-thermography with mechanical loss angle heating at ultrasonic frequencies*

Posters:

- J 4P: L. Wawrzyniuk, G. Dymny, *I nterferometric-thermographic method for surface deformation investigations*
- J 5P : B. L. Arlov, Yu. N. Kofanov, G. A. Pjatnitskaja, A. V. Segen, S. U. Uvajsov, *Termo vision control; interferometry and computer modelling for increasing reliability elements and units of high precision devices*

END OF QIRT '96
Announcements.

The proceedings of QIRT 96 will be soon available in a hard-bound format. Inquiries should be directed to:

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