Monday morning July 26th, 2010, Room A

Course A - Basic Thermography (3 hours)

Prof. V. Vavilov, Tomsk Polytechnic University (Russia),
Prof. X. Maldague, Université Laval (Canada)

1. Mechanisms of heat transfer conduction, convection, radiation

2. Basics of InfraRed
    - Radiation laws (emissivity, absorptivity, reflectivity)
    - Radiometry and temperature measurement
    - Noise considerations

3. On thermal stimulation in the active approach
    - Pulse thermography
    - Step heating (long pulse)
    - Lockin thermography
    - Vibrothermography

4. Experimental techniques
    - IR Detectors
    - Experimental set-up

5. Deployment, data processing and applications
    - Data processing
    - Applications

Monday afternoon July 26th, 2010, Room B

Course B - Applications of IR Thermography to Thermo-Fluid-Dynamics (3 hours)

Prof. Giovanni Maria Carlomagno, University of Naples Federico II (Italy)

1. Basics of infrared thermography
2. The fundamental laws
3. Performance of an infrared scanning radiometer
4. Restoration of the thermal image
5. Heat flux sensors for convective heat transfer measurements
6. Operating modes
7. Detailed applications of the:
   - heated-thin-foil steady state technique
   - thin-film sensor unsteady technique
8. Other application examples, in brief
9. Conclusions

Monday afternoon July 26th, 2010, Room A

Course C - Application of dynamic thermography to Nondestructive Testing (3 hours)

Prof. G. Busse, University Stuttgart, Germany

1- Introduction: Conventional thermography

2- Dynamic thermography: response of solids and sub-surface defects
- Oscillating temperature fields (Thermal waves, Lockin-Thermography)
- Transient thermography (Step function response)
- Burst thermography (Principle and applications)
- Pulse thermography (Principle and applications)

3- Methods of Lockin-Thermography and their application
Thermal waves and photothermal detection
Lockin-thermography = phase sensitive thermography= multiplex photothermal imaging

3.1- Lockin thermography with optical excitation (OLT)
- Coatings (paint, veneered wood, ceramics on metal...)
- Laminates
- Electronics

3.2- Lockin thermography with sound or ultrasound excitation (ULT)
(Heating with loss angle or friction: defect-selective NDE)
- Cracks
- Delamination
- Impact
- Corrosion

3.3- Induction Lockin thermography (ILT)
- Crack tips in metal
- Impact damage in CFRP
- Disbond in C-SiC-Ceramics

4- Data fusion and filtering in scatter plot for feature extraction

5- Conclusion
- Advantages/Disadvantages as compared to other NDE-methods
- Emerging developments

Monday morning July 26th, 2010, Room B

Course D - Application of thermography to buildings (3 hours)

Prof. E. Grinzato, CNR-ITC, Padova (Italy)

1. Introduction
2. From the energy to the surface temperature
3. Thermal model of buildings in steady and transient regime
4. IR Thermography indoor and outdoor
5. Boundary conditions monitoring
6. Evaluation of thermal properties of building materials:
    a. Thermal diffusivity
    b. Thermal effusivity
    c. Thermal conductivity
    d. Heat Capacity
7. The energy saving problem
8. NDE of structure strengthening
9. Moisture detection on buildings
10. Envelope and Heating Ventilating Air-Conditioning (HVAC) plant performances
11. Case study: floor and ceiling radiant heating systems
12. Heritage Buildings
    a. Decay of the structure and finishing
    b. Hidden structures location and identification (NDT)
    c. Painted surfaces Non Destructive Evaluation (NDE)
13. Conclusions