Laboratory Course n° 2
–
Infrared Imaging

Objective

The goal of this practical work is to study the application of IR imaging to temperature measurement and to observe the influence of several parameters on the efficiency of these measurement.

Equipment

- PC Computer
- IR Camera – Cedip SC7000
- Hotplate
- Industrial Parts and Electonic Circuit

Software

Altair Software

Documentation

- Technical Manual of the camera

Study of the camera and Altair Software

Getting start : defect detection on an electronic circuit

The camera is connected on the Ethernet port of the computer. Press the power button of the camera and launch the Altair Software. You have to wait that the temperature of the camera is stabilized first obtain infrared images (5 minutes).

First at all create a new project on the desktop where all your images and films will be saved

Open live camera. Choose the colour palette you want. Freeze one image and save it (using the F9 to freeze the image and F12 to export it in BMP or JPG format).

On the electronic circuit you can see on the table, something is wrong. Install the electronic circuit in front of the camera and press on the button.

Using the tools of Altair software determine the position of the defect on the circuit board, the maximum temperature of this point, the mean temperature of the circuit and the profile temperature.

Camera calibration

Using the hot plate and the digital thermometer, propose an experimental setup in order to realise the temperature calibration of the camera. You can of course use the tools of Altair Software to record and measure what you need.

Present onto a 2D graphic the relationship between the real temperature and the digital level (DL).

Give some comments and critics on the calibration process. Do you think that the infrared source is good for this experiment? Why?

Estimation of emissivity, transmission and reflection coefficients

Propose experimental setups in order to estimate the emissivity, the reflection and the transmission coefficient for several materials.

- Estimate the emissivity of wood.
    - You can use black paper in order to obtain a temperature reference (we will consider that the emissivity of the black painted steel object is about 1).
- PVC
    - Does this material is opaque in the visible domain? in the IR domain?
    - Estimate the transmission coefficient
- Copper
    - Does this object is specular in the visible domain? in the IR domain?
    - Estimate the reflection coefficient

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Active thermography

In this part you will use the IR camera in an application of NDT. A halogen is used as the IR source and is controlled by a sinusoidal voltage generator.

In all this experiments you can use recorder tool of Altair Software.

First experiment

Put in front of the camera the painted picture. Do you see the details of the image of the picture?

You will fixed the frequency of the voltage generator to 0,5 Hz.

Start halogens in order to heat the picture.

After one heat, stop the halogen and observe what's happen when you stop the halogen). What do you observe? What's happen after a few seconds?

Second experiment

A plate with flat-bottom-holes is used for this experiment. Do you see the holes in the image.

You will fixed the frequency of the voltage generator to 1 Hz.

Start the halogen. Start the recorder of Altair Software in order to save 2000 frames.

Start the player and comment what you observe.

Conclusion

Using the two previous experiments, explain give examples of the appications of active thermography.