FLIR APPLICATION STORY

FLIR SYSTEMS

FLIR Systems infrared camera helps

with thermographic evaluation of forced convective heat transfer coefficient on short pin fins at university of Ancona

Infrared thermography is a non-contact and non-invasive temperature measurement technique. It requires a very short experimental set-up and gives excellent results. These are some of the reasons why the University of Ancona is using a FLIR Systems ThermaCAM™ in its research programs.

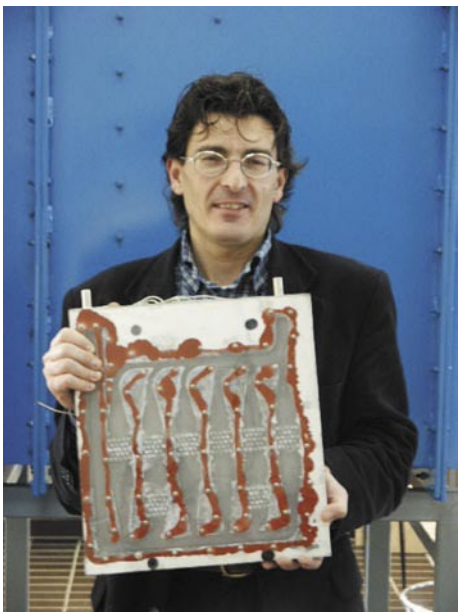
New cooling methods for electronic components

Enhanced heat transfer surfaces based on short pin fins are frequently used in different engineering fields. For example in microelectronic applications and in gas turbine blades cooling.

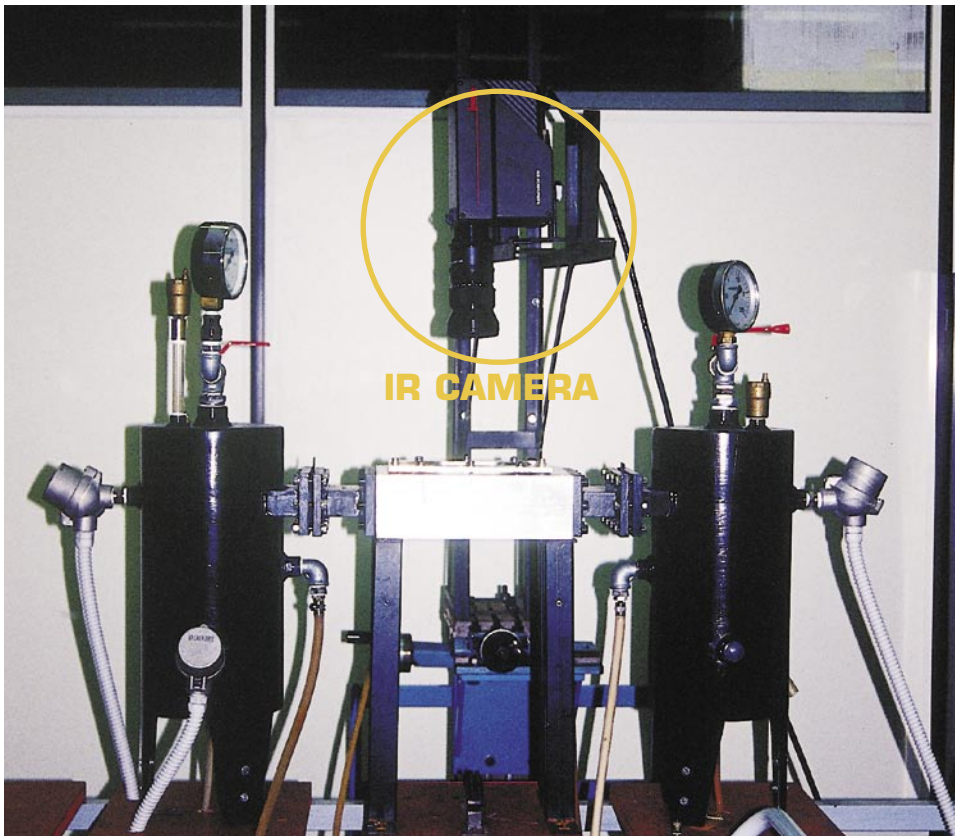
The air is commonly used as cooling element in these applications and good thermal performances are carried out by the systems based on these heat removal technologies. Unfortunately, when the specific thermal flux, generated by the components, is ranging from 50 to 100 W/cm2 forced air-cooling technique is not able to ensure the thermal control.

A good choice in these cases seems to be the closed loop liquid cooled systems, where the water may be used as working fluid. This technology may be applied to telecommunications equipments and perhaps in new generation of the desktop computers.

The aim of the research, by means of infrared temperature measurements, is the evaluation of the forced convective heat transfer coefficients of liquid cooled short pin fins in single, in line and staggered array configurations. The research results may be used to design cold plate heat exchangers to dissipate the heat flux generated by power electronic components.



Professor Ricci holding one of the cold plate heat exchangers



The set-up for the study with the FLIR Systems ThermaCAM™

Four pin shapes (circular, square, triangular and rhomboidal) have been analysed in single and in line pin arrangements. The experimental apparatus is composed of a closed liquid loop to supply a test section where the enhanced heat transfer surfaces are inserted. One side of the test section is equipped by an infrared window to observe, with a FLIR Systems IR camera, the pin tip temperature.

INFRARED: FOR FAST AND ACCURATE RESULTS

According to Professor Ricci, "The choice of the Infrared (IR) method permits to make very quick and accurate thermal measurements, avoiding the insertion of thermocouples into the pins. Furthermore, infrared has a very fast experimental set-up and gives real time responses. Another technique, naphthalene sublimation, has been successfully used to determine the convective heat transfer coefficient in short fins. Unfortunately the methodology seems too complicated for industrial tests, and the time required to get back a large amount of experimental data is too long. Since the infrared camera sees the slightest temperature differences, the results obtained by using a FLIR Systems ThermaCAM are in perfect agreement with those obtained by other authors and other techniques"

Extensive ink flow visualizations were carried out for each pins shape, in order to better understand the thermal and fluid dynamic behavior of the fins.
At the moment other arrangements and pin shapes are under testing and a special attention will be devoted at the telecommunications applications.

If you would like more information about this research, please contact Professor Ricci
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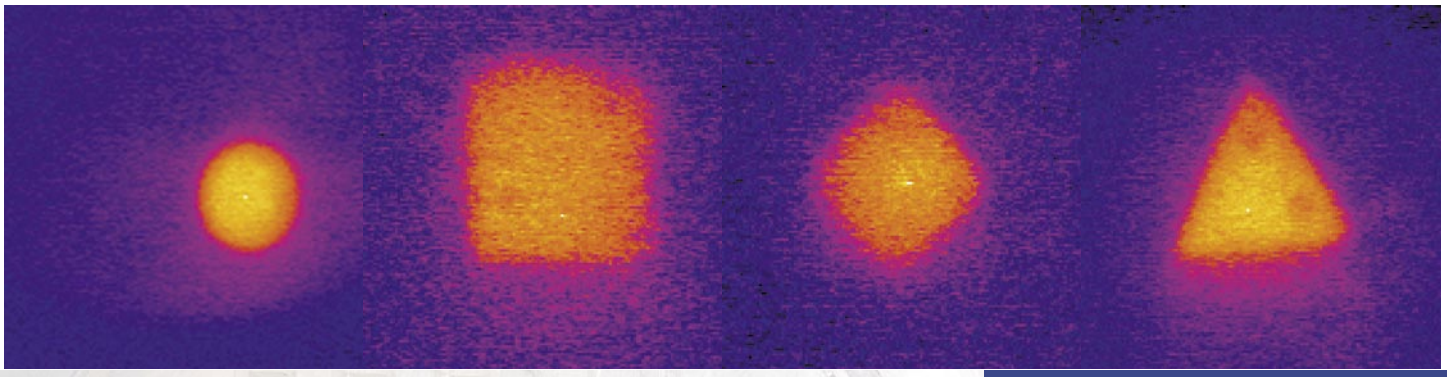
Infrared images of the tested pin shapes



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