



دولة ليبيا
وزارة التعليم العالي والبحث العلمي
الجامعة الإسلامية
كلية الهندسة

قياس الموصلية الحرارية باستعمال القياسات الحرارية ومقارنتها مع
النمذجة الرياضية (CFD)

Estimating thermal conductivity using thermal
measurements and validating the result with
mathematical model (CFD)

مشروع تخرج مقدم الى قسم الهندسة الميكانيكية والصناعية بالجامعة الإسلامية
الإسلامية كجزء من متطلبات نيل شهادة البكالوريوس في الهندسة الميكانيكية
والصناعية

بواسطة

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ABSTRACT

Thermal conductivity is an important property in thermal science research, especially for solid material, where heat transfer occurs mostly by conduction process.

This work illustrates the processes of design and fabrication of thermal conductivity probe to measure thermal conductivity of different types of material. The production of this probe is simple and not expensive.

This research work describes most of the available techniques for thermal measurements and thermal conductivity measurement. The final design of thermal conductivity probe made based on the principle of two parallel plates. The probe evaluated and tested for three known materials, which are Chrome Nickel Steel (18% Cr, 8% Ni), Granite, and wood samples.

The thermal conductivity probe has been built based on simple and cost affordable technique; the probe has one thermocouple on each side of the six faces of the sample, that is, in order to be able to collect more data and to insure the steady state condition.

The six thermocouples and the air temperature thermocouple are connected to a DAQ system to collect measurement data.

The numerical solution (Finite difference solution) has been coded in Matlab software. By comparing the numerical solution (CFD) versus experimental measurements for temperature distribution, there was small error (1.41%). Throughout investigation of the comparison, the two dimension solution model can be approximated to the one dimension solution, since the insulation was good. Some suggestions for improving the probe and its functionality were discussed in detail as well.