

ANALYTICAL METHOD FOR ON-LINE DETERMINATION OF THERMAL
PROPERTIES OF MATERIALS IN AN ABSORPTION CALORIMETER

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This work is my own and has not been submitted in any other university.

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ABSTRACT: A Microsoft FORTRAN 77 computer program for on-line determination of thermal properties (absorptance α and emittance ϵ) of materials has been developed. It uses data from sample heating and cooling histories obtained in an absorption calorimeter by Mulwa G.W (1991). The calorimeter is a box chamber having a window, sample holder, tungsten halogen lamp and a microcomputer with instrument interface to control the opening and closing of the shutter window. It is automated with a Z80 microprocessor system, which has an operating system (OS) and control programs resident in a block of type 2716 EPROMS with a working memory comprising type HITACHI 6116 static RAMS. The Z80 μ P system acquires the data from the sample through thermocouples, filters, amplifiers and analogue-to-digital signal converters (ADC) for temporary storage in the on-board RAM. Analytical solutions of heat balance equations of the calorimeter are computed for the data using numerical methods. Newton's iteration procedure for systems of nonlinear equations is used with the assumption that these properties are constant in the temperature range considered (20°C - 60°C). Computed values of the properties are substituted into the analytical equations for verification of temperature history. The IBM PS/2 model 50z microcomputer has been used for data processing and display of results. Results obtained for commercial copper and aluminium samples compare well with those computed by other methods.