Theoretical aspects of the integration of thermography and pyrometry methods

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Both thermovision and pyrometric measuring are widely used for the control of industrial process thermo modes, the technical service and diagnostics of equipment as well as the works on security and safety provision.

The objective of thermovision measuring is the visualization and research of an object thermo field on the basis of temperature gradient identification at defined temperature sensitivity. The main purpose of pyrometric measuring is the identification of temperature values in certain object points with certain accuracy.

Nowadays, it is expediently to solve the complex task based on both methods advantages' unification in many technological processes: identification of object thermo field point temperature values with the needed accuracy. For this purpose it is necessary to integrate the methods of thermography and pyrometry on the basis of usage of these methods' advantages as well as common disadvantages' correction.

Both thermovision and pyrometric measuring are tightly connected between themselves. When different tasks are available, they are based on common laws, have similar principles of measuring system construction, and moreover, they have common problems. Along with small values of measuring means, reaching (0,1 ÷ 1,0) % [1], and their high temperature sensitivity, up to (0,5÷1,0) °K [2], the uncertainty of measurement results can make hundreds of degrees.

The low accuracy of temperature identification as a result of non-adequacy of the accepted mathematical model of a temperature measurement object due to eradiation and real physical phenomena belongs to shared disadvantages. The main factors causing the uncertainty of a measurement result are presented in the figure 1.

Factors causing the uncertainty of measurement results and the possible ways of its decreasing are analysed. The intervals of wave lengths which are supposed to be used for certain range temperature measurement are determined on the basis of the research of central values of atmosphere main component eradiation lengths. Experiments on the research of an atmosphere omission coefficient at different atmosphere pollution and in different weather conditions at maximum distance of 50 m as well as its influence on measurement result uncertainty are conducted. The exploration of dependence of a different materials' eradiation coefficient on temperature and wave length is conducted. Approximating dependences of an eradiation coefficient on temperature are formulated. The influence of background eradiation of different intensity on the results of temperature measurement is explored. The conditions of the possible ignorance of background eradiation are defined. As a result of given experiments, measurement result uncertainty caused by the influence of considered factors is estimated.

As a result of pyrometry methods' analysis conducted in (1), it is shown that multispectral pyrometry methods enable us to increase the accuracy of temperature measurement in certain conditions. Therefore they are supposed to be used in the thermography. The requirements to the optimum meanings of parameters of constructive elements - filters and eradiation detectors - and possibilities to use them for multispectral measuring are determined on the basis of their analysis.

Thus wider implementation of pyrometry precision methods in thermographical measuring enables us to decrease measurement result uncertainty and to widen their functional facilities.

1. *Gots N. The Analysis Monochromatic Multichannal Pirometry. Abstract of V international conference PROBLEM OF INDUTRIAL HEAT ENGINEERING.-Kyiv, Ukraine.- 2007,- s.300-302.*
2. *Gilbert Gaussorgues. La Thermographie Infrarouge: Principes-Technologie-Applications . Paris.-LAVOISIER.-1999,- 586p.*

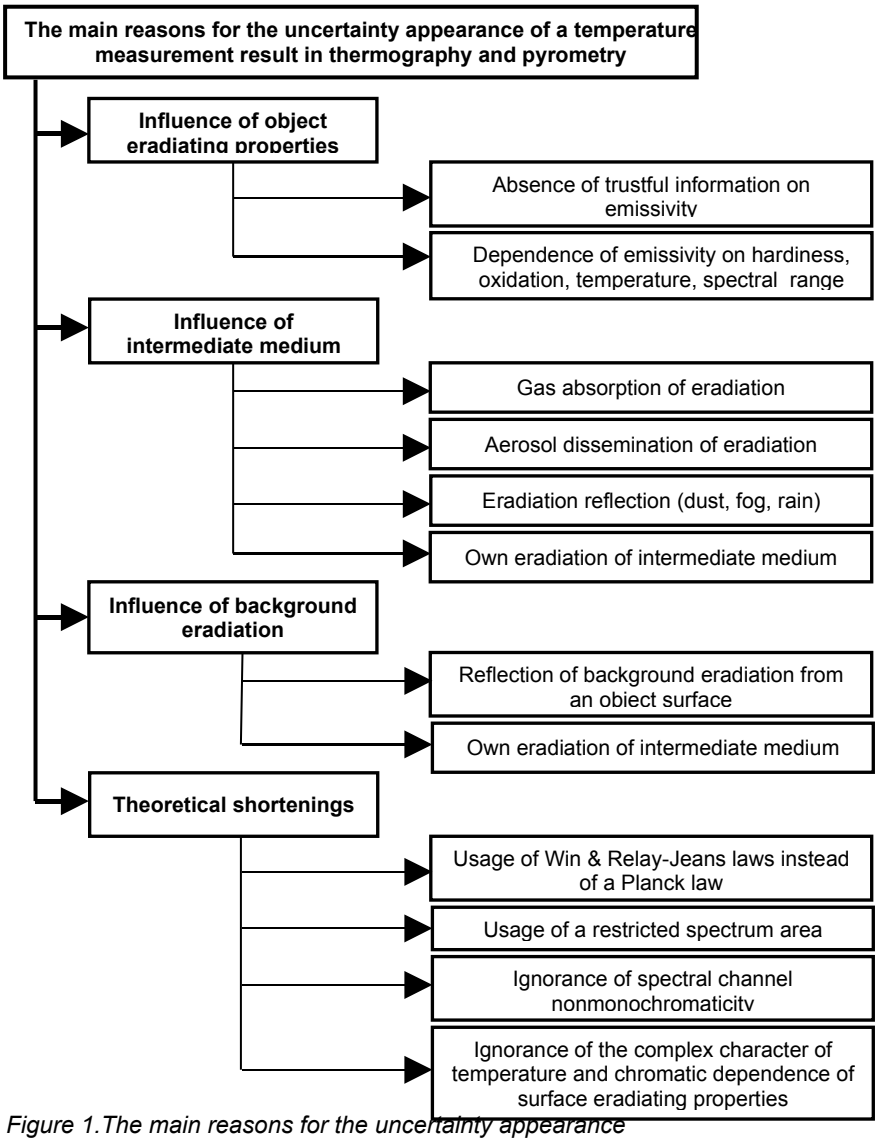

Figure 1.The main reasons for the uncertainty appearance of a measurement result in thermography and pyrometry