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The study on the measurement accuracy of non-steady state temperature field under different emissivity using infrared thermal image

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Abstract: In this paper, the temperature measurement accuracy of infrared thermal image under different emissivity is studied. Firstly, according to the formula of infrared temperature measurement, the influence of the object surface emissivity on the measurement accuracy of infrared thermal image is analyzed. The factors affecting the emissivity of the object are found. Secondly, the limitation of classical emissivity calculation method in infrared temperature measurement is explained. Thirdly, a model for improving the temperature accuracy of the non-steady state temperature field based on the emissivity of the infrared image is obtained, and the theoretical formula is obtained. Finally, three experiments of cast iron and stainless steel are carried out. The correctness and feasibility of this method is verified by the experimental results.

Keywords: infrared thermal image; temperature measurement accuracy; emissivity; thermal radiation; temperature field.

1 Introduction

With the progress of infrared temperature measurement technology, infrared thermal image temperature measuring technique has been aroused general concern because of its unique advantages, such as non-contact measurement, no damage, wide temperature range, measurement results visual in image, low power consumption, and good portability.

So the measuring method of infrared thermal imager plays an irreplaceable role in national defense, agriculture and industry, construction, medical service and other fields. However, the measurement accuracy of infrared thermal image is affected by various environmental factors easily. The application of infrared thermal image is limited by these factors. The most uncertainty of these factors is the emissivity of

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