

THERMAL IMAGE ANALYSIS USING CALIBRATED VIDEO IMAGING

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ABSTRACT

This research work introduces new techniques for temperature measurement that utilizes visual spectrum of light. A periscope with a CCD camera is used to capture the image from a high temperature gas fired furnace and calculate the temperature distribution of flame and furnace wall. The proposed visual thermal imaging methods for calculating the flame or wall temperature profiling are applied in several experiments in the laboratory and commercial furnaces. These novel approaches include reference technique which utilizes a known temperature measured either by an infrared optical device known as IR-Gun or thermocouples; and camera response curve method which utilizes two-color blackbody technique and flame adiabatic temperature condition. The camera calibration technology is also utilized and integrated with these temperature calculation methods to enable the temperature measurement in a specified region and produce a three dimensional temperature profiling. Various experiments are performed and temperature data are collected both with IR-Gun and thermocouples. These data are then compared with the results of CCD camera images using the proposed methods. Calculated temperatures from various experiments indicate that these methods yield excellent results that are closely comparable with both the IR Gun readings and thermocouples records.