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ABSTRACT

Object detection method using analysis of polarized long wavelength infrared radiation

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The aim of the dissertation was to devise a method of signal processing applicable to imaging infrared polarimeter allowing for detection of masked objects both artificially or naturally. The developed method takes into account polarizer's rotation during frame integration and readout (from a microbolometric array) and allows for operation without phase locked loop. Moreover, in order to enhance image quality and ease image interpretation by an operator, a dedicated filtration method consisting in statistical analysis has been devised.

Within the scope of the work a model of a device (a time division polarimeter) has been designed and manufactured, and finally it has been used to verify the method. The signal processing method was tested in MATLAB environment with time continuous signal. The method is highly parallelizable and designed for pipe-line processing. Moreover, a new method of calibration, insensitive to ambient conditions fluctuations, has been developed. The polarimeter achieves polarimetric image refresh rate of 5,45 Hz.

Effectiveness of the method and overall functioning of the polarimeter have been verified by analysing registered signal from the polarimeter for several test objects and for specialized set of test plates placed at different distances to the polarimeter – both masked and unmasked.

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