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Evaluation of superficial cracks as real defects in railway applications by means of active thermographic techniques

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Rail inspection is an important task in railway maintenance since surface cracks can affect the structural integrity of rails. In this regard, non-destructive techniques represent a useful tool for obtaining a rapid inspection with quantitative information about defects. Nowadays, ultrasonic inspection is the best control for detecting internal cracks, but it shows some problems in detecting superficial cracks. This work focuses on the potential use of active thermographic techniques as a control to investigate the rail components and real defects to support ultrasounds in normal types of control, in investigating for superficial and sub-superficial defects. The results of two different thermographic techniques, the flying spot laser thermography and the induction thermography will be presented and summarized. The limitations, advantages and disadvantages will be shown for both the techniques, starting from the use of very similar lab setups and the same IR sensor used to acquire the data. A complete experimental study will be presented to determine the influence of some parameters such as the energy density and the pulse duration for both the proposed solutions in terms of energy sources. Furthermore, a first evaluation of the effect of the relative motion between sample and IR camera has been carried out to evaluate the influence on the obtained results. The comparison between the two adopted techniques has been evaluated in terms of thermal contrast, but also considering different post-processing algorithms to improve the quality of the raw thermal data and so the achieved results.