Investigation of the influence of the afterglow effect on commonly used methods of infrared thermography, based on improved empirical representations of the flash lamp pulse shape.

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In this work, the influence of the afterglow of a source impulse on commonly used data processing methods of infrared thermography (IRT), such as Pulsed Phase Thermography (PPT) and Thermographic Signal Reconstruction (TSR) was investigated. For this purpose we propose the application of a modified and improved mathematical model or rather an empirical function to approximately describe the flash lamp pulse, which we recorded during the test with a photodiode. Two such models are considered, the first one describes the entire pulse signal, the second only the decreasing part. We compare our models with known state-of-the-art empirical functions and present an algorithm, based on Hough transform-clustering for automatically determination of the end of the pulse. Also statistical research was carried out to check the reproductively of the pulse shape or rather parameters. The results from applying the first model as pulse correction is compared to another widespread IR data treatment methodology, such as Modified Differential Absolute Contrast (MDAC). Experiments were performed, using two different specimens: a homogeneous polymer sheet with blind holes and an inhomogeneous plate made of carbon fiber reinforced polymer (CFRP) with artificial defects made from Tetrafluorethylen-Hexafluorpropylen-Copolymer (FEP) foil inserts. In both experiments a quantitative comparison was made using the Tanimoto criterion (TC), indicating an improved sensitivity.