Model assisted studies for the design and exploitation of active infrared thermographic techniques

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Infrared thermography (IT) has recently gained a lot of attention in the community of nondestructive testing, thanks to a number of advantages that it offers with respect to methods like the magnetic particle testing or dye penetrant testing. It does not require chemical products, it can be integrated inside a production process and it provides digital sets of images that can be easily recorded. This alternative meets thus the requirements of a greener industry and that of an evolution toward industry 4.0. This paper presents two applications, where the use of simulation is a critical element in the study. The first one is the estimation of thermal parameters from IT measurements carried out using halogen lamps as a heat source. The parametric estimation problem is discussed, taking into account uncertain parameters like the convection loss. The second application consists in the design of adapted inductors for the robotized inspection of samples with complex shapes using the induction thermography technique. A coupled electromagnetic and thermal modelling approach has been used in order to optimize both the inductor dimensions and its trajectory. Depending on the complexity of the source and sample geometry, semi-analytical, hybrid modal / numerical or 3D numerical techniques implemented in the CIVA software were combined.