

Lockin Thermography with Eddy Current Excitation

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A new innovative lockin thermography method is presented where inductive heating by eddy current is used for sample excitation. In conventional eddy current testing damages like cracks in metals are detected with a coil which changes its impedance over defect areas. The disadvantage of this method is its time consuming scanning over the surface of the sample. Induction lockin thermography (ILT), however, uses a thermography camera with a detector array to monitor induction heated areas. Temperature patterns and their time dependence responding to the coded excitation allow for fast imaging of defects in larger areas without the need of slow point-by-point mapping.

The mechanism involved is: An induction coil induces eddy currents in conducting materials. These eddy currents generate resistive heat which is monitored by the infrared camera. Cracks in the sample heat up higher than homogeneous material due to locally enhanced eddy current density which is analysed by the thermographic system.

Inductive heating with thermographic recording of the heating sequence was performed previously on compressor blades where the image of highest contrast was used for damage detection. At ILT the induction frequency (around 100 kHz) is amplitude modulated with a lockin frequency similar to ultrasound lockin thermography. Fourier analysis performed at this lockin frequency on the temperature image sequence provides amplitude and phase images with a signal to noise ratio which is significantly better than in single temperature shots. Phase thermography images have further advantages like the suppression of temperature gradients introduced by the inductive heating.

Figure 1 shows an example of ILT obtained on a metal tensile specimen containing a crack. The crack tips stand out clearly as black spots in the phase image.

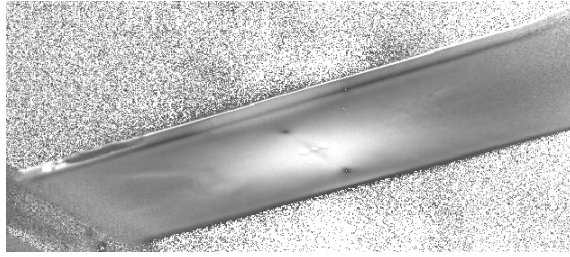


Figure 1: Tensile specimen with crack, Phase image at 1Hz

Results of this new lockin thermography method on several different defects and materials are presented in the paper.

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