On the feasibility of defect detection in composite material based on thermal periodic excitation

Titre	On the feasibility of defect detection in composite material based on thermal periodic excitation
Type de publication	Article de revue
Auteur	Lascoup, Bertrand [1], Perez, Laetitia [2], Autrique, Laurent [3], Crinière, Antoine [4]
Editeur	Elsevier
Type	Article scientifique dans une revue à comité de lecture
Année	2013
Langue	Anglais
Numéro	1
Pagination	1023-1030
Volume	45
Titre de la revue	Composites Part B: Engineering
ISSN	1359-8368
Mots-clés	B. Defects [5], D. Non-destructive testing [6], D. Thermal analysis [7], Modulated photothermal method [8]
Résumé en anglais	Implementation of periodic thermal excitation to identify thermal properties (conductivity, heat capacity, diffusivity) of complex composite materials at different investigation scales (from micrometer to millimetre) presents many advantages. These methods are usually based on the thermal waves phase lag observation compared to a reference signal. In fact, phase lag evolution versus distance to the heating source or versus excitation frequency is quite informative about numerous material characteristics. For example, considering that a structural defect can modify heat propagation inside a material, diagnosis can be performed from phase lag observations and comparisons between samples with and without defects. Numerous studies have been performed considering global heating (a quite large surface of the investigated composite material is heated and defect depth or size can be detected). The proposed approach is original since periodic heating is local and aims to detect defects in the periphery of the excitation. Based on a mathematical model for thermal waves propagations and introducing complex temperature for numerical resolution (finite element method), a feasibility study has allowed a sensitivity analysis. This preliminary study also provides information on the operating protocol, for heating (frequency, power, size of the source), and observation (transmission or reflection). Then, experimental device and early experimental results are briefly exposed.
URL de la notice	http://okina.univ-angers.fr/publications/ua5798 [9]
DOI	10.1016/j.compositesb.2012.07.020 [10]
Lien vers le document	http://dx.doi.org/10.1016/j.compositesb.2012.07.020 [10]

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