

Simulation of Impact Damage in a Composite Plate and Its Detection

Vitalijs Pavelko¹, Igors Pavelko¹, Maxim Smolyaninovs¹, Helge Pfeifer², Martine Wevers²

¹Riga Technical University, Riga, Latvia

²Catholic University Leuven, Belgium

Abstract

A problem of damage prediction in aircraft structure and its non-destructive evaluation is very important for aircraft structural health assessment. The analysis of the features of direct impact of thin-walled laminate component of aircraft was performed by COMSOL Multiphysics software. The effect of materials of contact pair, geometrical form of projectile, its mass and initial velocity as well as also structure of the thin-walled composite plate, material performance, boundary conditions and others parameter was investigated. Mainly the GFRC and CFRC laminates were selected in form either thin separate plate or sandwich structure. The low-velocity impact was simulated. For laminate usually it associated with delamination which effect to compressive strength of long fiber composite is very significant. This damage is internal and its non-destructive detection is important for system of aircraft structural health monitoring (SHM). The simulation of A-scan and C-scan (Figure 1) procedures using ultrasound Lamb wave technology was performed. Some regularities of ultrasonic guided wave propagation in composite sheet with different kinds of damage were investigated by the simulation and compared with the special test. The problems of the use of GW in SHM of aircraft for damage detection in composite components are discussed.

Acknowledgement: The research leading to these results has received funding from the European Community's Seventh Framework Program [FP7/2007-2013] under grant agreement n° 212912. The authors are grateful to European Commission for financial support and all partners for scientific and technological collaboration.

Figures used in the abstract

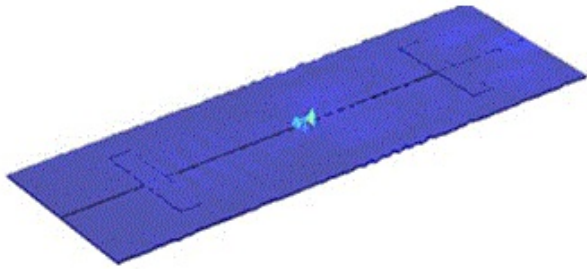


Figure 1: Simulation C-scan of a composite plate by ultrasonic method.

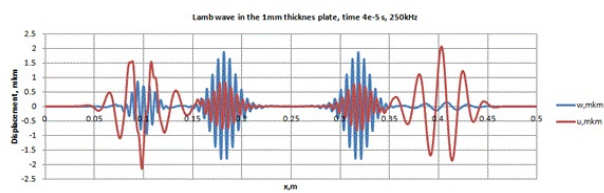


Figure 2: The guided wave (GW) interaction with damage of 1 mm composite plate (length 0.5 m).