



A VIABLE CAPACITIVE APPROACH FOR DAMAGE DETECTION OF AIRCRAFT COMPOSITE MATERIAL

Dong Ensheng, Jiang Yilin, Guo Wei, Yu Xiangbin

The Aircraft Control Department

Aviation University of Air Force, Nangan Zone

Jilin, China

Emails: Dongensheng@Tsinghua.org.cn; dongens63@yahoo.com.cn

Submitted: Sep. 19, 2012

Accepted: Jan. 14, 2013

Published: Feb. 20, 2013

Abstract- Military and Commercial aircraft are being constructed by more and more advanced composite materials. In order to prevent catastrophic failure any damage in aircraft composite material should be detected as soon as possible. The relations of the electrode length, the electrode width, and the space between electrodes to the testing sensitivity of the uniplanar double electrodes are investigated. A three dimensions model of the uniplanar capacitive sensor with 8 electrodes is founded and the optimization for the structure parameters of the sensor with 8 electrodes is carried out. According to the optimization, a uni-planar capacitive sensor, with 8-electrode on one plane substrate and a ground screen electrode and the screen between electrodes, is designed to get the corresponding capacitance information of the measured composite material slab. 2 aircraft composite material slabs, one is healthy and the other is notched, are used as a sample for the experiment of detecting the damages. The preliminary experimental results show that the measured capacitances decrease after damage occurs in aircraft composite material and that the proposed

approach can effectively detect the damage of aircraft composite material. The proposed approach is a viable technique for in-situ damage detection of aircraft composite material.

Index terms: Uni-planar capacitive sensor, sensitivity simulation, optimization, FEM, damage detection, composite material.