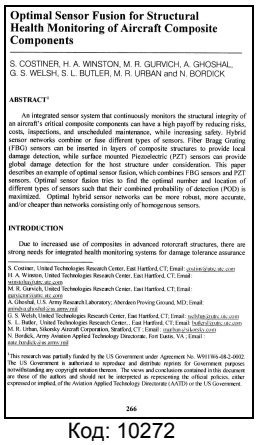

Optimal Sensor Fusion for Structural Health Monitoring of Aircraft Composite Components

S. COSTINER, H. A. WINSTON, M. R. GURVICH, A. GHOSHAL, G. S. WELSH, S. L. BUTLER, M. R. URBAN and N. BORDICK

ABSTRACT[1]

An integrated sensor system that continuously monitors the structural integrity of an aircraft's critical composite components can have a high payoff by reducing risks, costs, inspections, and unscheduled maintenance, while increasing safety. Hybrid sensor networks combine or fuse different types of sensors. Fiber Bragg Grating (FBG) sensors can be inserted in layers of composite structures to provide local damage detection, while surface mounted Piezoelectric (PZT) sensors can provide global damage detection for the host structure under consideration. This paper describes an example of optimal sensor fusion, which combines FBG sensors and PZT sensors. Optimal sensor fusion tries to find the optimal number and location of different types of sensors such that their combined probability of detection (POD) is maximized. Optimal hybrid sensor networks can be more robust, more accurate, and/or cheaper than networks consisting only of homogenous sensors.

INTRODUCTION

Due to increased use of composites in advanced rotorcraft structures, there are strong needs for integrated health monitoring systems for damage tolerance assurance

S. Costiner, United Technologies Research Center, East Hartford, CT; Email: costinsh@utrc.utc.com
H. A. Winston, United Technologies Research Center, East Hartford, CT; Email: winstoha@utrc.utc.com
M. R. Gurvich, United Technologies Research Center, East Hartford, CT; Email: gurvicmr@utrc.utc.com
A. Ghoshal, U.S. Army Research Laboratory; Aberdeen Proving Ground, MD; Email: amitha.ghoshal@us.army.mil
G. S. Welsh, United Technologies Research Center, East Hartford, CT; Email: welshgs@utrc.utc.com
S. L. Butler, United Technologies Research Center, , East Hartford, CT; Email: butlersl@utrc.utc.com
M. R. Urban, Sikorsky Aircraft Corporation, Stratford, CT; Email: murban@sikorsky.com
N. Bordick, Army Aviation Applied Technology Directorate, Fort Eustis, VA ; Email : nate.bordick@us.army.mil

[1]This research was partially funded by the US Government under Agreement No. W911W6-08-2-0002. The US Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation thereon. The views and conclusions contained in the document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Aviation Applied Technology Directorate (AATD) or the US Government.

Код: 10272

S. Costiner, H.A. Winston, M.R. Gurvich, A. Ghoshal, G.S. Welsh, S.L. Butler, M.R. Urban, N. Bordick

Optimal Sensor Fusion for Structural Health Monitoring of Aircraft Composite Components

Издательство DEStech Publications, Lancaster, 2011 год

8 стр; формат: 23,5 x 16 см; библиографический список: 17 единиц
ISBN: 978-1-60595-053-2

An integrated sensor system that continuously monitors the structural integrity of an aircraft's critical composite components can have a high payoff by reducing risks, costs, inspections, and unscheduled maintenance, while increasing safety. Hybrid sensor networks combine or fuse different types of sensors. Fiber Bragg Grating (FBG) sensors can be inserted in layers of composite structures to provide local damage detection, while surface mounted Piezoelectric (PZT) sensors can provide global damage detection for the host structure under consideration. This paper describes an example of optimal sensor fusion, which combines FBG sensors and PZT sensors. Optimal sensor fusion tries to find the optimal number and location of different types of sensors such that their combined probability of detection (POD) is maximized. Optimal hybrid sensor networks can be more robust, more accurate, and/or cheaper than networks consisting only of homogenous sensors.

Ключевые слова:

Содержание.