

Effect of laser pulse fatigue on carbon fiber reinforced composites

Seung-Chan Hong¹, Jung-Ryul Lee¹, See Yenn Chong¹ and Chan-Yik Park²

¹Chonbuk National University, South Korea

²Agency for Defense Development, Korea

A laser ultrasonic based nondestructive evaluation (NDE) technique has been widely used in aerospace industries. Generally, the service lifetime for an aircraft could be more than 25 years. Thus, the composite structures of the aircraft could be susceptible to laser pulse fatigue damage caused by the laser pulse energy in the long-term repetitive maintenance inspection. In this paper, the effect of laser pulse fatigue of an unpainted and a painted carbon-fiber-reinforced polymer (CFRP) plate (USN175BX Carbon UD prepreg) with the stacking sequence of [0/45/-45/90]_s to verify the reliability of the use of a laser ultrasonic scanning on the CFRP structure inspection. A high-speed laser ultrasonic scanning system of 1 kHz pulse repetition rate (PRR) and the spatial intervals of 0.4 mm with laser mirror scanner (LMS) was setup to perform repeat scanning of 1300 times at the five laser pulse energy levels in 532 and 1064 nm Q-switched continuous wave lasers (QL). These repeat scanning times were set in consideration of the long-term repetitive maintenance inspection scheduled to be 1 time/week x 52 weeks/year x 25 years. Elastic modulus assessment based on ultrasonic Lamb wave pitch-catch method in consideration of temperature was used and the surface condition of the scanned area was investigated by a microscope. In addition, the laser pulse energy for maximum signal-to-noise ratio without damage was investigated. Both CFRP plates were excited by 1064 nm QL at 1 kHz PRR 1300 times at each of impinging points and the surface condition of CFRP plates was investigated through the microscopic images.

Biography

Seung-Chan Hong has been getting his master's degree from the Department of Aerospace Engineering in Chonbuk National University. He is associated with Los Alamos National Laboratory, Chonbuk National University Engineering Institute, Korea.

qtchans@nate.com