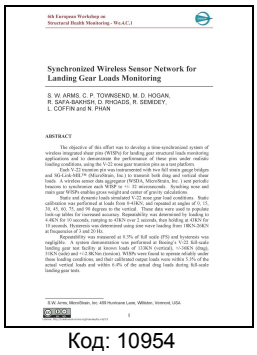

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Synchronized Wireless Sensor Network for Landing Gear Loads Monitoring

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The objective of this effort was to develop a time-synchronized system of wireless integrated shear pins (WISPs) for landing gear structural loads monitoring applications and to demonstrate the performance of these pins under realistic loading conditions, using the V-22 nose gear trunnion pins as a test platform.

Each V-22 trunnion pin was instrumented with two full strain gauge bridges and SG-Link-MIL™ (MicroStrain, Inc.) to transmit both drag and vertical shear loads. A wireless sensor data aggregator (WSDA, MicroStrain, Inc.) sent periodic beacons to synchronize each WISP to +/- 32 microseconds. Synching nose and main gear WISPs enables gross weight and center of gravity calculations.

Static and dynamic loads simulated V-22 nose gear load conditions. Static calibration was performed at loads from 0-43KN, and repeated at angles of 0, 15, 30, 45, 60, 75, and 90 degrees to the vertical. These data were used to populate look-up tables for increased accuracy. Repeatability was determined by loading to 4.4KN for 10 seconds, ramping to 43KN over 2 seconds, then holding at 43KN for 10 seconds. Hysteresis was determined using sine wave loading from 18KN-26KN at frequencies of 3 and 20 Hz.

Repeatability was measured at 0.3% of full scale (FS) and hysteresis was negligible. A system demonstration was performed at Boeing's V-22 full-scale landing gear test facility at known loads of 133KN (vertical), +/-36KN (drag), 31KN (side) and +/-2.8KNm (torsion). WISPs were found to operate reliably under these loading conditions, and their calibrated output loads were within 5.3% of the actual vertical loads and within 6.4% of the actual drag loads during full-scale landing gear tests.

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Ключевые слова:

Содержание