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# Continuous health monitoring of stationary and moving structures based on e/m impedance method, using deposition of piezoelectric thick film transducers

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Structural health monitoring of stationary and moving structures has been considered based on electromechanical impedance/admittance (EMI/EMA) spectrum of deposited piezoelectric thick films as wafer active transducers. This method is one of the effective approaches to predict the probable damages in a variety of sensitive structures like turbofans, compressors, and specifically titanium or super alloy blades in aerospace industries. In this study, thick piezoelectric films of a) PbZr0.52Ti0.48O3- PZT, b) Bi4Ti3O12-BiT, c) PZT-PZTcomposite, and PZT-BiT composite, were deposited on the convex surfaces of nickel-based super alloy blades Ruston-TA 1750 (IN738) and Pratt&Whitney JT8D (IN718) for structural health monitoring with different thicknesses and properties using photochemical metal-organic deposition and hybrid sol-gel techniques. Thereby, a desirable crack-free coating was obtained with minimal agglomeration, porosity, residual stress and maximum achievable piezoelectric charge coefficients, ferroelectric remnant polarization and dielectric constants. Implementation of new, eco-friendly and additive-free precursors to synthesize up to 100 µm thick films on curved surfaces is one of the important substantial achievements in present research. The E/M impedance/admittance spectrum was derived for transducers on the flat surface of an Aluminum plate and curved surface of IN738 super alloy blades at two pristine and damaged conditions at 20°C and 200°C (stationary state). The impact of damage formation and temperature increase were detected on the impedance peak amplitudes and the corresponding resonance/anti-resonance frequencies of the pristine and damaged structures. Therefore, it is possible to detect the formation of initial damages due to fatigue and corrosion prior to any catastrophic failure in stationary and moving states using statistical analysis of E/M impedance spectrum.

## Biography

HamidrezaHoshyarmanesh received his PhD at the age of 31 years from Isfahan University of Technology, Isfahan, Iran in 2014. He joined the MCLAB in South Korea in 2012 and 2013 as a visiting researcher. He works in manufacturing and mechatronics group of Azad University, Khomeinishahr branch in Isfahan from 2001 as a lecturer with more than 15 papers, books and patents in Persian and English. He was formerly the head of Robohexapod research group in Isfahan Science and Technology Town. He has been serving as reviewer for ASABE and WSEAS. His research interests include mechatronics, manufacturing processes, industrial automation, piezoelectric sensors and actuators, and structural health monitoring.

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