

Master 2015

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**Piezo Driver for Lamb-Wave Generator on a Wireless SHM
Sensor/Actuator Node.**

ABSTRACT - Masterthesis

Structural Health Monitoring (SHM) becomes vital part in maintenance field of aging aircraft and critical civil structure in order to ensure the safety of human life. In response to that need, Piezo Active Wafer Sensor/Actuator (PWAS) could be used to monitor the health of structure by Electro-mechanical impedance method. PWAS generates mechanical lamb waves in composite structure upon excitation by the suitable electrical signals. Reception of such lamb wave signals on another PWAS could reveal the possible damage inside the structure by converting mechanical signals back in to electrical signals.

The design of PWAS excitation driver is always been a concern because of small size requirement and frequency demands in the range of few hundreds kilohertz. The goal of this master thesis is to design a PWAS driver which can generate hanning windowed sine signals of few kilohertz for excitation of PWAS. The idea is to use a full-bridge class D power amplifier, driven by a pulse width modulated (PWM) signal, to generate a hanning windowed signal, which is required to drive PWAS. This idea will be thoroughly discussed during this thesis and selection of this approach will be justified against system requirement. Modulation method, amplifier selection and suitable filter approach will be discussed in detail before the beginning of driver design. First of all Simulation of proposed driver will be done in Simulink in order to analyse performance affecting parameters of system which will forms a base for original hardware design and its ability to function. Based on simulation result, hardware will be designed and tested with original PWAS. The detailed measurement and performance affecting parameters will be mentioned in order to justify the functioning ability of driver.