

Data fusion based damage study using Electromechanical Impedance Method

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Applications

- ✓ There is a search of effective damage identification solutions for light weight structures (e.g. aeroplane fuselage, wind turbine blades) to prevent failures. One of the promising method is the EMI method.

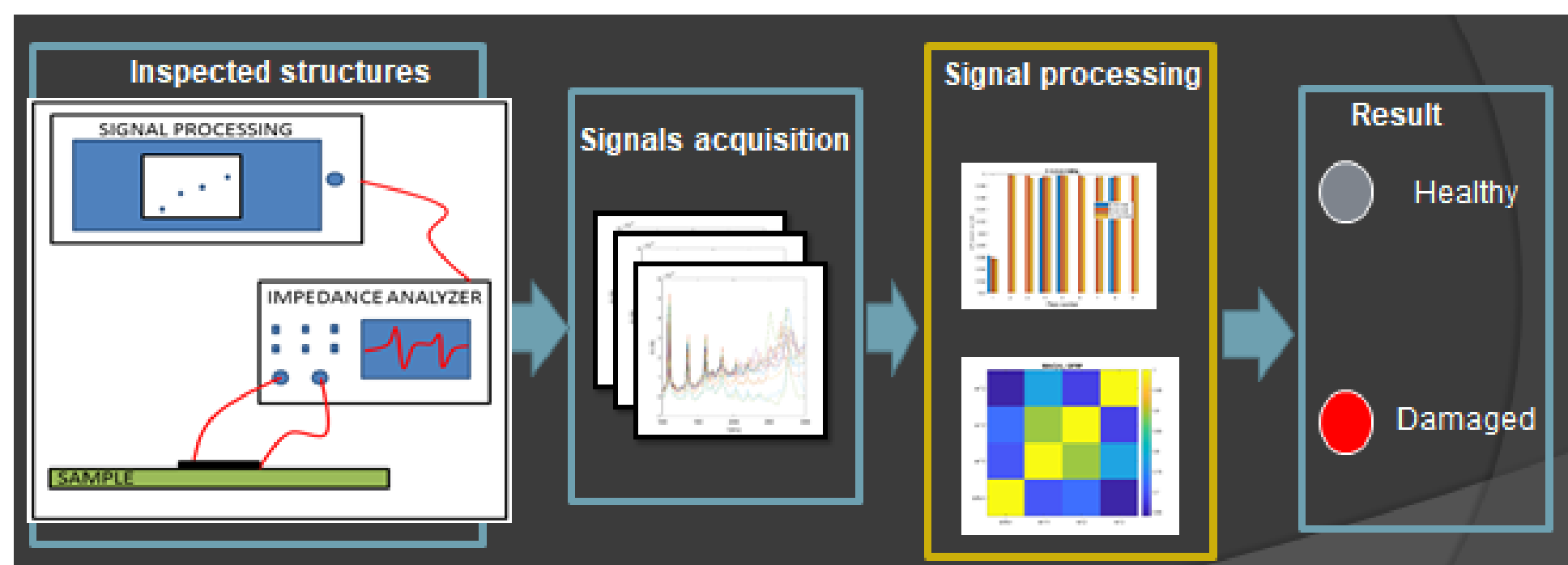


Introduction

- ✓ The electrical impedance of the bonded PZT transducer is equal to the voltage (V) applied to the PZT transducer divided by the current passing through the PZT

$$Z(\omega) = \frac{V}{I}$$

- ✓ Due to mechanical coupling the electrical response contains information about mechanical condition of the structure.
- ✓ The EMI method employs high frequencies range in assessing the local structural response by application of statistical indices.



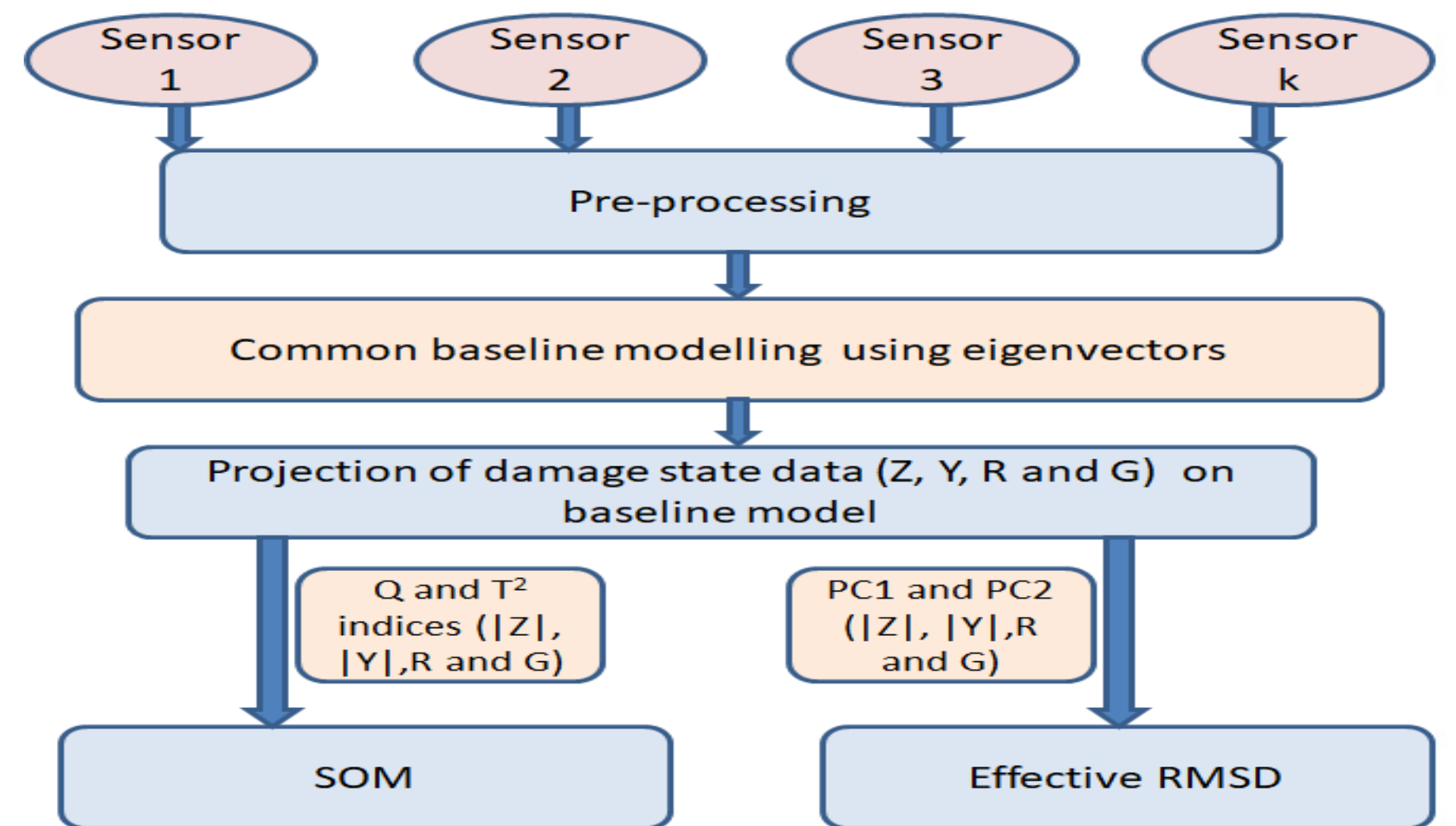
Sample for investigation

- ✓ Sensor network diagram of Al plate used for damage detection in data fusion technique. Damage severity study based on different size of drilled hole (1) 5 mm and enlarged (2) 8 mm hole in the Al plate. The impedance (Z), admittance (Y), Conductance (G) and resistance (R) EMI data used for the data fusion in damage detection of hole severity.



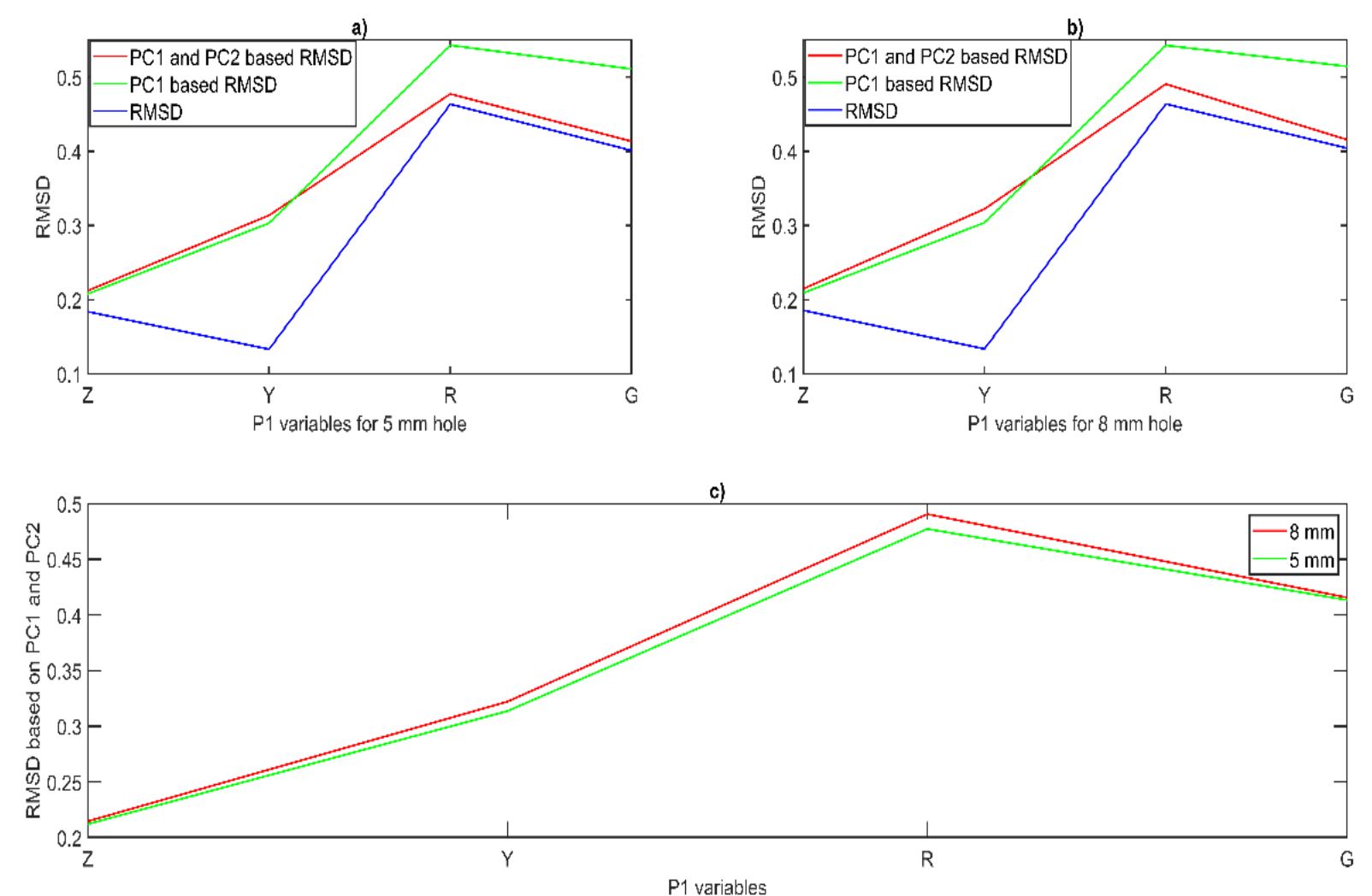
Methodology

- ✓ Data-driven data fusion based damage detection using PCA and self organizing map (SOM).



Results

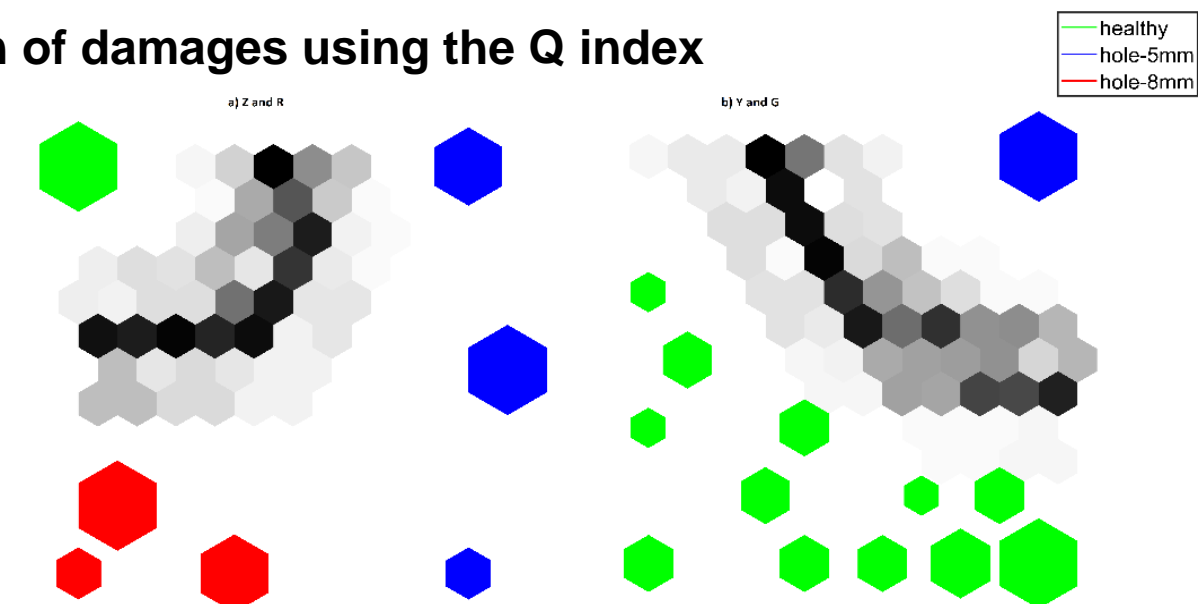
- ✓ A comparative study of RMSD and PCA based fused RMSD for a) 5mm, b) 8 mm and c) P1 fused RMSD for 5 mm hole and 8 mm hole.



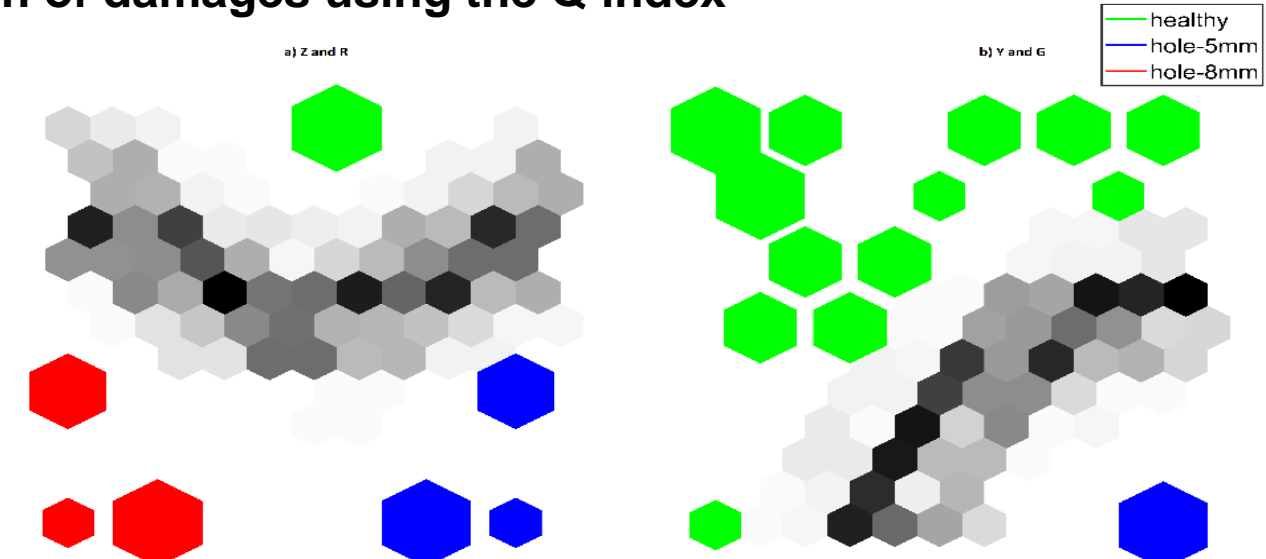
The most common PCA based damage detection indices are Q index and the Hotellings T² index.

- ✓ Q index used to analyze the variability of projected data in the residual subspace
- ✓ T² index used to analyze the variability of projected data in the new space of the principle components.

Classification of damages using the Q index



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