

DESCRIPTION FOR THE GENERAL PUBLIC

The research about structural health monitoring has been conducted in many research units around the world. Various techniques are being developed for such systems. The promising techniques are the electromechanical impedance and elastic wave propagation. Many successful applications of these two techniques for damage assessment can be found in the literature. On the other hand there is a tendency to develop lighter and more optimal structures in order to reduce the use of materials and energy. For example the use of lightweight materials (i.e. fibre reinforced composites) in aviation leads to fuel saving while for reducing the amount of materials and structural optimisation the manufacturing method of 3D printing (also known as additive manufacturing) is used. Such techniques were initially used for rapid prototyping. Contemporarily, they start to replace traditional manufacturing allowing for saving of materials producing less wastes.

The project aims at investigation of phenomena related to the electromechanical impedance method as well as elastic wave propagation occurring in the additively manufactured elements. This different manufacturing technique causes that damage detection and localization approaches will be different from those used for traditional materials. 3D printing has a directional character that influences the way how elastic waves propagate in the material. This requires investigations and next incorporation in the damage assessment techniques. The project aims not only at the use of the two techniques for damage detection and localisation but also for damage size and type estimation. It should be underlined that these two problems have not been fully solved for traditional materials. This makes the undertaken tasks a challenge, that can lead to interesting observations and conclusions. Although, the project is not dealing with traditional materials it can be foreseen that the developed damage assessment method could be also applied for them with relatively few modifications to the signal processing algorithms.

Until recently there have been only a few works published that dealt with structural health monitoring of additively manufactured structures. Those already published were analysed in this project proposal. The drawn conclusions and identified problems will be used in the planned research.

In this project both electromechanical impedance and elastic wave propagation was proposed for determining differences between elements without damage, with damage and repaired ones. Both techniques will be used separately as well as in combined manner. Combined advantages of both techniques may lead to better results. The advantages of such approach will be also investigated.