Lamb wave based technology being one of the advanced approaches in the field of ultrasonics, is being widely considered to perform Structural Health Monitoring (SHM) in damage tolerant aeronautical structures. Damage tolerance is a concept in which damage up to a tolerable size is allowed to exist in structural components before those components will have to be repaired. To get such damages detected reliably, an automated inspection process based on SHM technology is considerable. However, it is important to know at what features such SHM technology needs to look at such that the appropriate key performance indicators (KPI) can be well identified. Such an identification may be best done through numerical simulation which is the purpose of the paper being proposed here. Referring to guided ultrasonic waves and here specifically to Lamb waves different modes being sensitive to the tolerable damages defined have to be identified such as the S0 mode for through thickness cracks and possibly others for further types of damage. To optimize the quality of the Lamb wave modes generated in the first place, two actuators have been placed opposite to each other on the top and the bottom of the plate like structure considered. Changes in the plate geometry such as thickness have been detected through a mode conversion and the dispersive effect of the mode considered i.e. the S0 mode. In this paper the approach on how to determine the input features for an artificial neural network (ANN) will be described on a numerical basis as well as the resulting KPIs obtained through the ANN. At first, the concept is explained using a plate with five holes from which cracks emanate and will be finally explained for a riveted patched repair such as widely used in aeronautical structures.

**KEYWORDS**

Lamb waves | Artificial Neural Networks | Structural Health Monitoring | Damage tolerant design | Key Performance Indicators |