Numerical modeling of fatigue in adhesively bonded joint

Hanan Alali

Department of Mechanical Construction and Production, Ghent University

Supervisor(s): Prof. Magd Abdel Wahab

The use of adhesive bonding is becoming much more widespread in these recent years, because it has a lot of advantages comparing with the traditional joining techniques such as welding, riveting, brazing and bolting .These joints can be used nowadays in many sectors, which include aerospace, automotive, electronics, packaging and shoes industries. They can also be used in human body (dentistry and ortobidice). Regarding the integrity of these joints, during their manufacturing process in the industry there will be cracks and flaws. These defects will be inevitable, and the presence of these flaws will affect the performance of adhesive bonding in service, or even cause catastrophic failure of the joint. The types of Joint configuration that can be found in the literature are as follows: Single lap joint, Double lap joint, Butt joint, Scarf joint ... In the literature, they studied SLJ experimentally and analytically to investigate the fatigue crack initiation and propagation. There have been difficulties in predicting fatigue crack initiation lifetime. Therefore, my research is to study the behavior of this joint, and other joints, numerically in order to analyse fatigue crack initiation. The main objective of this project is to develop numerical modeling techniques of fatigue - crack initiation in different joint configurations, e.g. SLJ, DLJ and LSJ. The individual objectives of my project are; a) to develop finite element models for crack initiation, then b) to apply this damage model to adhesive joints and finally c) to validate my code using experimental data. My Current research activates include: (1) Comprehensive literature review on the topic. (2) Develop damage evolution model based on CDM (continuum damage mechanics)and integrate it within FEA code (ANSYS) (3) Applying the damage model to several joints joint using FM 73aerospace adhesive. (4) Validate the FEA damage prediction using experiment data.

This research is possible thanks to the financial support of Albaath University, Homs SYRIA