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Development of a Computational Tool based on Analytical Formulation to Predict Fatigue Life of Adhesively Bonded Joints with a Cohesive Crack

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Abstract. Bonded, riveted, and bolted joints to assemble components or structural parts, is often used in aeronautic industries. With recent development of new materials and new manufacturing techniques, bonded joints have been increasingly used due to some distinct advantages over traditional riveted and bolted ones, namely: more efficient load transfer, better sealing, better finishing and, most important for aeronautical applications, less weight. Before this scenario the fatigue phenomenon deserves special attention due to the fact that it accounts for more than 90% of engineering failures. This paper describes a mathematical development of an analytical equation for the fatigue life prediction based on a formulation deduced by Krenk [1] for cracked bonded joints and the Paris law. This formulation was based on elasticity theory to derive analytical expressions for the energy release rate in mode I, mode II, and mixed mode and it can be used for fatigue failure prediction in adhesive joints under cyclic loading. The computational implementation was built using MATLAB® language. The software presents a friendly graphical user interface to facilitate their use in engineering analysis. These results will be validated through finite element analysis using the commercial software ABAQUS® and experimental tests.

[1] Krenk, S. (1992). *Energy release rate of symmetric adhesive joints*. Engineering Fracture Mechanics.

[2] Pirondi, A. & Moroni, F (2009). *An investigation of fatigue failure prediction of adhesively bonded metal/metal joints*. International Journal of Adhesion & Adhesives.