ASSESSMENT OF RESIDUAL ELASTIC MODULUS OF A 5HS WOVEN LAMINATE BY THE USE OF IMPULSE EXCITATION TECHNIQUE

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Abstract: Carbon fiber composites are widely used as structural components in the aeronautical industry because these materials present a good relationship between mechanical strength, elastic modulus, and low weight. However, these materials have a characteristically low strength in out-of-plane loads, which can lead to a reduced fatigue life. Aeronautical structures are subject to fatigue failure when in service, so this work presents the mechanical fatigue characterization of a composite of woven fabric type 5HS processed via resin transfer molding (RTM). In the present study, the decay of the modulus of elasticity resulted from the fatigue stress of the material was measured. The material once statically characterized is then subjected to dynamic stresses with different maximum loading stresses maintaining the ratio (R) constant equal to 0.1 for three stress levels (high, medium and low). The aim of this study is to evaluate the capability of the Impulse Excitation Technique (IET) in assessing the residual elastic properties of fatigue damage of woven composite laminates. To this aim, the elastic modulus for the longitudinal direction of undamaged and damaged laminates is evaluated with the IET. Specimens were cycled and the IET modulus was measured by IET at a predefined interval of cycles. The IET values are then interpreted through a simple model of the damaged laminate. Potentialities and weaknesses in the application of the IET for the assessment of the residual elastic properties in predicting fatigue failure are finally discussed and highlighted.

Keywords: Carbon fiber composite, IET, Fatigue, Residual Modulus