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Experimental investigation of composite lockbolt fastened joints under in-plane low velocity impact

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Abstract

Two different composite fastened configurations, i.e. the filled hole and the single-lap double-fastener joint, are experimentally investigated in tensile mode through different loading rates. The composite material system is the UD carbon/epoxy AS4/8552 and the coupons are fastened with titanium countersunk lockbolts. The experiments are performed in a range from quasi-static to 2.8 m/s impact velocity, using an innovative testing device developed and adapted in a drop tower machine. The main experimental observations are the limited loading rate sensitivity in terms of strength for both tested configurations, the elevated absorbed energy values in the dynamic tests of the lap joint samples, as well as the differences in their failure evolution and modes between quasi-static and impact loading.

Key Words: A. *Polymer-matrix composites (PMCs)*; B. *Impact behaviour*; D. *Mechanical testing*; E. *Joints*

1.0 Introduction

Over the past few decades, the use of fibre-reinforced composite materials in aircraft structures and other advanced engineering applications has been widely expanded in lieu of conventional materials, such as aluminium and titanium alloys, due to their inherent superior behaviour. Boeing 787 and Airbus A350XWB are two characteristic examples of the latest generation of large commercial aircrafts, the fuselage of which consists by over 50% in weight of composite materials. The potential benefits of the composite lightweight material systems tend to be limited in some extend, when different composite parts are fastened together in order to construct the complete structure. The fastened joint areas are critical structural elements for the design of safe and efficient composite structures, as they represent the