Modelling of an Improvement Device for a Tension Test Machine in Crippling Tests

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Abstract: An analysis of the crippling test applied to thin profiles is considered in this paper by using a standard tension test machine. Crippling tests are compression tests leading to crush collapse. This kind of tests cannot be properly performed in the standard test machine because of an inefficient transmission of the compression load to the specimen. To accomplish a more accurate test an improvement device is designed and modelled. This proposed device consists of four symmetrically-arranged guides joining the two machine heads. The head rotation is thus avoided during the test and the compression load is transmitted to the profile without introducing bending effects through the heads. In order to show the advantage of the new design, the two cases (with and without the guides) have been analysed with Abaqus and compared one to another. The test results are also presented for the initial machine. The numerical model includes heads, potting, clamps and a C-shaped profile as specimen. This one is a carbon fibre composite modelled as an orthotropic elastic material. It results from the analysis that the proposed design provides more accurate values for the critical loads in the crippling test.

Keywords: Compression Tests, Crippling Tests, Composites.

1. Introduction

Thin profiles are commonly used in aerospace applications. In order to determine their compressive behaviour, the specimen is forced to a crushing process by compression load. This test is known as “crippling test” and is considered in this work.

When using a standard test machine (Instron model 4485), the test gives rise to important instabilities because of the introduction of bending besides compression into the specimen deformed shape. The machine heads lack the required stiffness for a reliable test.

A possible way to avoid the introduction of undesired bending is to design an implement to guide the parallel motion of the machine heads. This is proposed here by means of four symmetrically-arranged guides joining the two machine heads.