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DYNAMIC RESPONSE ANALYSIS OF PRESSURIZED CABINS SUBJECTED TO DECOMPRESSION LOADINGS

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Summary. *Although pressurized fuselage protects crew and passengers from the lethal environmental effects, decompression accidents continue to be the cause of aircraft and lives losses. During decompression, in fact, the air mass moves through the aircraft compartments in a non-uniform manner and this cause pressure differentials that may further damage primary and secondary structures. It is, therefore, clear that the interest in developing accurate models able to simulate cabin response to decompression loads is of great interest in current times when aircraft continue to fly at higher altitudes.*
In this work, a methodology for the dynamic response analysis of fuselage sections undergoing rapid and explosive decompressions is devised by coupling a zero-dimensional gasdynamic model with higher-order beam structural theories. The zero-dimensional formulation for the gasdynamics of decompression events of pressurized aircraft is developed by assuming an adiabatic, reversible transformation. The model developed is able to take into account both supercritical and subcritical decompressions as well as venting systems of multi-compartment aircraft [1]. On the other hand, the elasticity of fuselage structures is taken into account by implementing refined beam theories within the framework of the Carrera Unified Formulation (CUF) [2]. Thanks to CUF, in fact, very efficient but still accurate structural models able to capture global and local mechanical behaviours of complex aerospace structures can be implemented with ease [3]. By employing a modal superimposition method, various time-domain response analyses are carried out and the high efficacy of the methodology developed is widely validated and discussed.

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