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Abstract

In launchers, composite sandwich structures are often the preferred designs for non-pressurised primary structures due to their advantages compared to metallic structures (i.e. lightweight structure with high stiffness and high buckling capacity). For flight readiness, each composite structure shall be qualified. The qualification process covers global and local verification including material testing, structural and dynamical analysis, damage tolerance analysis and full-scale testing.
The damage tolerance of composite structure including non-destructive inspection is then a critical aspect in the justification of new sandwich structure. Damage tolerance aspects are considered early in the development phases in order to increase the structure robustness. The fracture control requirements specific to composite structures will first be shortly presented; the requirements are derived mainly from two standards: an in-house design requirements applicable document and ECSS-E-ST-32-01C standard which serves as reference document.
An example of justification with respect to fracture control will then be presented for an advanced composite primary structure. Various types of defects were investigated: delamination, hole which conservatively simulates defects affecting the thickness of the skin and mechanical impact. The present paper focuses however on low velocity mechanical impact because of its criticality in terms of detectability. The justification relies on test only. Destructive and non-destructive tests were performed to assess the degradation of the structure containing damage.