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Structural integrity assessment on cracked composites interaction with aeroelastic constraint by means of XFEM
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Abstract
In this paper, a novel approach in assessing the structural integrity of cracked composite plates under the aeroelastic condition by using XFEM is presented. To the authors' knowledge, this is the first time that aeroelastic condition is coupled in XFEM to model the crack propagations. Previous researches from the literature had only considered a static crack condition. This research focuses on determining the first failure experienced by the cracked composite plate, either the crack will propagate causing a fracture, or the composite plate will fail due to aeroelastic instability imposed at the critical flutter speed. The proposed scheme is used to solve the limitation in XFEM within Abaqus that only general static and implicit dynamic analysis can be performed. The structure is assumed to interact with minimal gust, and the deflections by time are expressed in the equation of periodic motion based on Fourier Series Function (FSF). The results show that at a particular fibre orientation, once the damaged composite plate is deformed due to the dynamics load at dive speed, it fails due to the crack propagation first instead of the flutter. In contrast, another fibre configuration shows good resistance to crack propagation and fails due to flutter instability. © 2019 Elsevier Ltd

Author Keywords
Aeroelastic; Composite structure; Crack; Extended Finite Element Method (XFEM); Fourier Series Function (SFS); Gust

Index Keywords
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