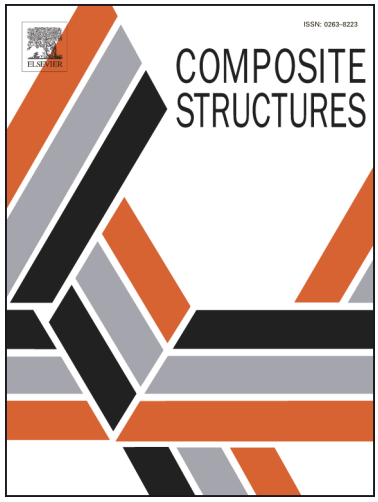

An analytical scaling approach for low-velocity impact on composite structures

Raffael Bogenfeld, Janko Kreikemeier, Tobias Wille

PII: S0263-8223(17)32155-4
DOI: https://doi.org/10.1016/j.compstruct.2017.12.012
Reference: COST 9169

To appear in: *Composite Structures*

Please cite this article as: Bogenfeld, R., Kreikemeier, J., Wille, T., An analytical scaling approach for low-velocity impact on composite structures, *Composite Structures* (2017), doi: https://doi.org/10.1016/j.compstruct.2017.12.012

An analytical scaling approach for low-velocity impact on composite structures

Raffael Bogenfeld*, Janko Kreikemeier, Tobias Wille

German Aerospace Center, Institute for Composite Materials and Adaptive Systems, Lilienthalplatz 7, 38108 Braunschweig, Germany

Abstract

For the analysis of low-velocity impact, this work provides an analytic scaling approach, permitting to analyze structural impact scenarios on a small reference coupon. Thus, the numerical prediction of impact damage on large structures through high-fidelity methods is made possible. Yet, the massive computational effort needed for these virtual tests even on a coupon level means a major challenge to their application in the design process of a structure. To reduce the computational effort, local analysis approaches consider only damage-prone areas for an actual damage analysis.

Our approach permits the analysis of structural impact scenarios on a much smaller reference coupon that represents the damage-prone area. An analytical spring-mass model transfers the impact parameters between the structural and the coupon level. For this purpose, the spring-mass model captures the impact-damage state by a scalar parameter. The transfer between the reference coupon and the structure is based on the equivalence of this damage parameter. Thus, a coupon simulation or coupon test result is given validity for a structural impact scenario. So, based on a single coupon simulation, areal impact assessment of a structure is made possible.

This methodology is validated through experiments and a demonstrated on a generic aircraft door structure.

*Corresponding author
Email address: raffael.bogenfeld@dlr.de (Raffael Bogenfeld)