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MACHINING 2D FEM STUDY OF LONG FIBRE REINFORCED UNIDIRECTIONAL LAMINATES USING A LINEAR CONTINUUM DAMAGE TECHNIQUE

F Cepero Mejias[1,2,3], JL Curiel Sosa[2,3] and V.A Phadnis[4]

[1] Industrial Doctorate Centre in Machining Science, The University of Sheffield, Sir Frederick Mappin Building, Mappin Street, S1 3JD Sheffield, United Kingdom, fmcepero1@sheffield.ac.uk, https://www.ms-idc.co.uk/meet-students
[2] Department of Mechanical Engineering, The University of Sheffield, Sir Frederick Mappin Building, Mappin Street, S1 3JD Sheffield, United Kingdom
[3] Computer-Aided Aerospace and Mechanical Engineering Research Group (CA2M), University of Sheffield, Sheffield, United Kingdom
[4] AMRC with Boeing, Advanced Manufacturing Park, Wallis Way, Catcliff, Rotherham, S605TZ, United Kingdom

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Long fibre reinforced polymer (LFRP) composites have been widely employed in different structural components. These kinds of materials due to their high strength-to-weight are specially demanded in parts with high performance applications. Therefore loads of important applications in aeronautical, automotive, sporting and marine industries are developed with the use of composites.

High dimensional precision in parts is required using different machining processes as milling, trimming or drilling to reach necessary assembly and dimensional requirements. From a manufacturing point of view, LFRP are considered as a difficult material to cut because of some factor alike the presence of hard fibres or low temperature resistance.

Because of that, several problems related to lose of the integrity of the part such as delamination, matrix thermal degradation or fibre pull-out has been arising in machining of composites. Hence, study of the influence of different cutting parameters and tool geometries (tool material, cutting speed, depth cut, rake and clearance angles and edge radius) has in parts integrity is essential to design an efficient machining process saving time and money without affecting part integrity.

This work contains a 2D FEM study of an orthogonal cutting machining problem of thick unidirectional laminates. A good agreement with experimental results with a specific machining parameters configuration is achieved to validate the model. A novel linear stiffness degradation in composites FEM machining problems is applied with the use of a continuum damage mechanic (CDM) model to obtain more realistic results. Tool is considered as a rigid body to reduce computational time in simulations. Several studies of influence of different parameter such as cutting speed, depth of cut, fibre orientation and rake and clearance angles has in the chip formation and subsurface damage induce in glass and carbon fibre reinforced polymers.