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DRILLING DAMAGE IN COMPOSITE MATERIAL

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Summary: In recent years it is possible to observe a huge growth of reinforced composite laminates usage as these materials have become one of the most interesting materials groups, due to their unique properties. In spite of this, there are still some cost-related and machining issues when considering the use of composite laminates.

Besides the relative complexity of the production process, machining operations like drilling are needed in composite structures. Usually, some damage in the region around the hole boundary is evident after the drilling operation is completed, being delamination the most serious as it can reduce the load carrying capacity of the joint. The main mechanism responsible for delamination is the indentation effect caused by the quasi-stationary drill chisel edge. In general, it is accepted that a drilling process that reduces the thrust force exerted by the drill chisel edge can prevent delamination risk. Several studies on this subject have been published and so it is possible to envisage a drilling strategy that keeps delamination risk at a minimum.

This work is focused on the determination of the critical thrust force for delamination onset for several stacking sequences and its effect on the delamination observed in carbon/epoxy plates. With this purpose, authors had performed delamination onset tests according to an existing procedure. Then, similar plates were drilled and delamination around the hole was quantified by the use of enhanced radiography and algorithms of image processing and analysis. Finally delamination onset results are compared with existing analytical models.

Results of this work show the importance of adequate knowledge of material properties when it is necessary to establish a drilling strategy for the machining of composite materials.

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