Thermo-mechanical evolution of the consolidation of a prepreg tape : Application to Automated Tape Placement Process

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ABSTRACT

Automated tape placement is a promising composite forming process based on the fusion bonding of a prepreg tape on a substrate. By heating the interface between the incoming tape and substrate, and applying pressure, a laminate part out of autoclave can be obtained in one step, making the process attractive for industry.
In order to reach in-situ consolidation with this process, the material has to undergo several steps: heating, consolidation, and cooling. During these three stages, different physical phenomena occur, the important point is that all these phenomena take place at material interfaces and are governed by temperature and pressure. One critical aspect concerns the consolidation step, when the bonding occurs, this part has already been treated in previous works, but the output descriptors are not satisfying from our point of view.
In the present work, we propose a novel approach to improve the understanding of the consolidation step, we first propose to model the surface as a fractal which parameters are extracted from a prepeg experimental characterisation, the surface is then compressed and squeeze flow occurs, and thermal exchanges at the microscales are computed[1-2]. We improve the fractal modelling by a wavelet description of the surface in order to work on a real surface topology and propose an experimental validation of outstanding results.

REFERENCES

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