METHODOLOGY TO TAKE INTO ACCOUNT GAP AND AS-MANUFACTURED FIBER ORIENTATION FOR AFP-MADE PART PERFORMANCE

Maarten Oudendijk

In Summa, The Netherlands

Automatic Fiber Placement (AFP) is a fast and efficient deposition process of carbon prepreg for large component application. To accommodate the composite strips onto a double curved surface, the tows can be cut and restarted and slightly misoriented yielding to the apparition of gaps between the tows. These two defects, i.e. the gaps and the misalignment of the tows affect the mechanical performance of the final part.
Robots, that execute that deposition of tows, are driven by the control software. This latter can be considered as the link between the part as-designed and the part as-manufactured. To assess final mechanical properties of the part, with the effects of the presence of defects, an additional link between the part as-manufactured and the part as-designed must be introduced.
Recent developments in material modeling applications now provide the possibility to predict the performance of the final part produced by AFP, using information coming directly from the control software. The development consists in reading information from control software such as the localization of gaps and the fiber orientation and to map such information onto the mesh used for structural analysis.
During a stress analysis of the component, a micromechanical model is used to compute the local material properties by considering the presence or absence of tows and the local fiber orientation.