FULLY AUTOMATED PARAMETERIZED MODEL CREATION OF ULTRA-LIGHTWEIGHT CARBON FIBER WRAPPED COMPONENTS IN ANSA

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KEYWORDS –
Scripting, Ultra Lightweight Structures, Automated

ABSTRACT
Using ANSA for the design and modelling of ultra lightweight carbon fibre wrapped structures is an area still in its infancy. ANSA geodesic curves, which are used to represent the carbon fibre rovings, are ‘fitted’ by hand using the TOPO tools, can be both time consuming, and tedious. Furthermore, the position of each roving plays a crucial role in the structures ability to effectively transfer the applied forces smoothly from the load itself down to its fixed base.
We present a methodology which aims to improve the design and manufacturing process through automating and parameterizing the curve fitting process, combining topological functions integrated into ANSA's python package and ANSA scripting.

The method presented here, aims to automate the creation of a 3d tube like structure, representing the mould to be wrapped with carbon fibre rovings, as well as simulate the wrapping process, all done using python and the ANSA python package. Taking a few input parameters, the algorithm advances along an axis defined by some arbitrary geodesic curve in space, systematically placing guidance points for generating multi-patch Face and surface entities. This process creates a 3d printed helical skeleton, consolidated in forms adapted automatically to the desired design. The fully automated wrapping process is simulated using KINEMATIC BODIES, which represent the 3d skeleton and the robotic tool head in ANSA. Steering of the robotic devices is achieved by means of geodic curves representing the fibre roving.

A finite element analysis using beam elements will illustrate the even transmission of compressive and tension forces in the structure showcasing the structure's integrity.