Abstract

The tape placement technique is of particular importance for the production of large and weight optimized structural components especially in the aeronautic industry. The components are produced independently of size and load directions by placing single unidirectional fiber reinforced tapes automatically. Moreover, very large component dimensions enable a reduction of joining processes.

In comparison to the thermoset tape placement, additional potentials can be set up through the usage of thermoplastic semi-finished materials, as beside the high degree of integration und the defined laminate construction less material specific problems and a non-autoclave production can be realized. This thesis follows an all-embracing analyses and development of the thermoplastic tape placement process to provide knowledge to overcome the deficits concerning semi-finished materials, systems engineering and available models for the process description.

First, the process is described and differentiated. Within the scope of a strategic process analyses, the potentials and strength of this process are worked out. Through a succeeding operational process analyses, the process is pictured in detail and further developments of the process and the control are made possible.

All aspects of the process in terms of quality of the semi-finished material, systems engineering, process control, and quality assurance are considered for the process development. Innovative concepts to solve the first layer problem and a new tape placement head are worked out.

A new model is developed to support strategic decisions on basis of component specific cycle times. A measure for the component shape complexity is derived and integrated into a continuous approach. The model is based on the process physics and can be applied to any component without a need for empiric data.

Finally, new process potentials are presented through a combination of thermoforming and thermoplastic tape placement.