Abstract:
Fibre reinforced plastics are widely used for energy absorbing parts. Due to their superior strength to density ratio they provide a high performance and are ideal for lightweight design for crashworthiness. For this, it is essential that the mechanical behaviour of fibre reinforced composites be predicted correctly by simulation. However, due to the complex inner structure, this is still a challenging task, in particular in case of highly nonlinear crash loading. In order to provide an alternative in this paper a virtual manufacturing simulation chain is proposed to gather detailed geometrical information about the roving structure of a filament wound tube on meso-scale. In addition effective material properties, based on calibrated models of the individual constituents, for the filament–matrix interaction are derived by micro-scale calculations. Both, combined with a USER MATERIAL model for the roving structure finally provide a complete finite element model which is used for the crash simulation of the filament wound tube. By comparing the numerical results to experimental data, the potential of the approach is shown and occurring differences are discussed as well as possible subsequent investigations are proposed.