In many cases, it is very challenging to evaluate experimentally the mechanical behavior of materials with microstructures made of fibrous networks due to the small dimensions of the specimens. Hence, to predict properly mechanical properties, network-scale models are required to obtain homogenized material properties by considering fiber-scale mechanisms.

The current study demonstrates how three-dimensional representative volume elements for fiber networks can be used within the finite element method in order to investigate the influence of micro-scale properties on the macro-scale material response. Both, current trends and open challenges, will be addressed with particular focus on nonlinear material models.