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**Localization simulation of a representative volume element with prescribed displacement
boundary for investigating the thermal residual stresses of composite forming**

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Abstract

In this research, a methodology of localization simulation that not only discriminately described fiber and resin but also considered the global influence like external temperature loading was introduced. The newly proposed representative volume element with a prescribed displacement boundary that was deduced from a generalized viscoelastic shear lag model can link the macro and micro models if the edge effect was ignored. After the material models and software platform were demonstrated through a composite warpage experiment, the proposed localization simulation was investigated by comparing to a large-scale fully microscale benchmark model in an ideal cooling phase. The results show that the temperature and residual stresses evaluated from the new technique not only presented details fine to the scale of the representative volume element but also included the macroscopic temperature gradient, indicating a promising way to understand the composite forming process in a comprehensive format.

Keywords: localization simulation; residual stresses; finite element analysis; composite forming; multiscale.

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