Mold filling simulations for RTM: Influence of the scatter of preform permeability

Frederik Desplentere

MaterialsMetallurgy & Materials Engineering Department, Katholieke Universiteit

ABSTRACT

The paper describes the incorporation of variability of preform permeability data into a mould filling simulation software (PAM-RTM from ESI-group). This implementation allows preventing bad gate and vent locations within more difficult injection set-ups.

The input for the statistical parameters of the local permeability scatter is obtained from a large number of permeability measurements [1]. Alternatively, the permeability can also be calculated if the internal textile geometry is known [2,3]. Stochastic input for those textile models is obtained by using micro CT measurements [4]. This geometrical data serves as input for our textile modeling software WiseTex, which provides textile model for permeability calculation software.

Assigning permeability values to each element in a finite element model can be done in a totally random way [5]. This approach can lead to very large differences in permeability between neighboring elements. This is not very realistic, because a textile reinforcement can be considered as a continuum hence preform permeability in neighboring points should be correlated. We have implemented this correlation, using the following general approach:

1.   Consider local distribution of permeability with an unknown standard deviation sl.
2.   Consider a correlation function with an unknown distance parameter a.
3.   Run Monte-Carlo simulations of flow through a rectangular preform
4.   Identify sl and a for the preform by comparison of results of (3) with a measured scatter of flow parameters.

The parameter sl and a will then be used to simulate a distribution of permeability over a 3D shaped preform for a part under consideration.

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