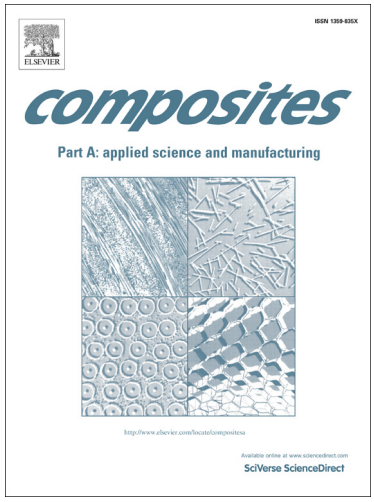

Data assimilation through integration of stochastic resin flow simulation with visual observation during vacuum-assisted resin transfer molding: A numerical study

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Data assimilation through integration of stochastic resin flow simulation with visual observation during vacuum-assisted resin transfer molding: A numerical study

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Abstract

This study investigated data assimilation through integration of visual observation with a stochastic numerical simulation of resin flow during vacuum-assisted resin transfer molding. The data assimilation was performed using the four-dimensional asynchronous ensemble square root filter and a stochastic numerical simulation by means of the Karhunen–Loève expansion of the permeability field. Through numerical experiments of linear flow, it was verified that the estimation accuracy of the resin impregnation behavior improved compared to that when using conventional data assimilation and that the permeability field could be estimated simultaneously, although it is not explicitly related to the observation. We also investigated the applicability of the proposed method to radial-injection VaRTM by varying the model thickness. The proposed method successfully estimated the resin impregnation behavior and permeability field. Additionally, the required condition for the number of ensemble members was clarified.

Keywords: Statistical properties/methods (C), Computational modeling (C), Process monitoring (D), Resin flow (E)