

DATA ASSIMILATION FOR MONITORING RESIN TRANSFER MOLDING OF COMPOSITE MATERIALS

Ryosuke MATSUZAKI¹, Akira TODOROKI², Masayuki MURATA², Masaya SHIOTA¹ ¹ Tokyo University of Science, 2641, Yamazaki, Noda, Chiba, Japan ² Tokyo Institute of Technology, 2-12-1 O-okayama, Meguro, Tokyo, Japan E-mail address: rmatsuza@rs.tus.ac.jp (R. Matsuzaki)

Abstract

Vacuum assisted Resin Transfer Molding (VaRTM) is widely used for molding of composite structures. However, ensuring complete impregnation of the resin into fiber materials is difficult and it sometimes causes the formation of un-impregnated regions, called dry spots. Due to the poor quality of a VaRTM process, its application is currently limited. Therefore, monitoring of the resin flow during the process is necessary to predict and prevent the formation of dry spots. This paper presents a method to observe resin impregnation in a VaRTM process without embedding sensors into composite structures. Planar-shaped sensor electrodes arranged on a molding tool are used to measure electrical capacitance values from pairs of the electrodes. These measurements are combined with the numerical simulations of a VaRTM process to estimate the state of the resin impregnation. This method is based on the ensemble Kalman filter (EnKF), known as a sequential data assimilation technique. The proposed method was examined by a numerical experiment. In the numerical experiment, the resin-impregnated region and the permeability distribution of a fiber preform were estimated concurrently and it was confirmed that the decrease of flow velocity in a low permeability region could be estimated.



































