Title Modelling of three-dimensional air temperature distributions in porous media

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Citation Biosystems Engineering, Volume 96, Issue 3, March 2007, Pages 345-360

Keywords three-dimensional temperature; ventilate; store product

Abstract

In this paper, three-dimensional (3D) temperature distributions in a ventilated empty room and room filled with obstacles were compared experimentally to evaluate the presence of biological material, such as stored products, on the temperature uniformity. During experiments, step inputs in inlet air temperature were applied and temperature responses at 36 sensor locations were recorded to develop a data-based mechanistic (DBM) model of the temperature response at different positions in the room. The simplified refined instrumental variable (SRIV) algorithm was used as model parameter identification tool to obtain the best model order and parameters. The developed model demonstrated to be an accurate representation of the system in both empty and porous media. The predicted temperature in the room had a good correlation, coefficient of determination R^2>0·99, with the measured data and the model provided several physically meaningful parameters to present the 3D temperature distribution in the porous media. The average accuracy was 0·1 °C.