USING a LEVEL-SET MODEL TO ESTIMATE DWELL TIME IN a VACUUM DEWATERING PROCESS FOR PAPER

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Abstract

Water removal during paper manufacturing is an intensive energy process. The dewatering process generally consists of four stages in which the first stage, water is removed due to gravity and low vacuum filtration. In the second stage, a higher level of vacuum is applied in a suction box. The third and fourth stages involve pressing and thermal drying. The thermal drying section exceeds the other drying stages in terms of energy use considerably. Hence, improving the mechanical dewatering processes prior the thermal stage could reduce major production cost. The vacuum dewatering process has been considered in this work. A laminar level-set method has been applied in order to capture the air/water interface during the dewatering process. The modelling process considers paper with a basis weight of 20 g/m2. A matlab-code was used to generate randomly positioned fibres in a 2D-structure. The model is composed of cylindrical fibres with a diameter and bound water content typical of kraft softwood fibres. The initial content of free water between the fibres being taken from laboratory data. Fifteen different structures were simulated in which water content and dewatering rate was compared. The aim of the model is to estimate a valid dwell time for the vacuum pulse.

Keywords: CFD, Level-Set method, tissue paper, two-phase flow, Navier-Stokes equations