

Experimental Study of the Fiber Dispersion of Pulp Liquid Flow in Channels with Application to Papermaking

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Abstract : This study explored the feasibility of improving the hydraulic headbox of papermaking machines by studying the flow of wood-pulp suspensions behind a flat plate inserted in parallel and convergent channels. Pulp fiber concentrations of the wake downstream of the plate were investigated by flow visualization and optical measurements. Changes in the time-averaged and fluctuation of the fiber concentration along the flow direction were examined. In addition, the control of the flow characteristics in the two channels was investigated. The behaviors of the pulp fibers and the wake flow were found to be strongly related to the flow states in the upstream passages partitioned by the plate. The distribution of the fiber concentration was complex because of the formation of a thin water layer on the plate and the generation of Karman's vortices at the trailing edge of the plate. Compared with the flow in the parallel channel, fluctuations in the fiber concentration decreased in the convergent channel. However, at low flow velocities, the convergent channel has a weak effect on equilibrating the time-averaged fiber concentration. This shows that a rectangular trailing edge cannot adequately disperse pulp suspensions; thus, at low flow velocities, a convergent channel is ineffective in ensuring uniform fiber concentration.

Keywords : fiber dispersion, headbox, pulp liquid, wake flow

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