

Sensitivity of premetered coating flows to sinusoidal disturbances

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This study has focused on the frequency response method to investigate the sensitivity of the premetered coating flows like curtain and slot coatings. In curtain coating process, sensitivity has been scrutinized using simplified 1-D viscocapillary model derived from 2-D curvilinear Navier-Stokes equations. To effectively analyze the complex system of the frequency response equation, several novel computation methods have been suggested and compared: conventional method, two-shot method, and modal analysis. Also, effects of process conditions on the sensitivity have been investigated. From the sensitivity results, it has been found that air pressure difference between top and bottom sides of the curtain makes the system more sensitive, leading to longer curtain trajectory. 1-D viscocapillary model has been derived In slot coating process, incorporated with power-law fluids by combining Couette and Poiseuille flows coating bead region. It has been also confirmed that sensitivity results by 1-D models quantitatively agree with those by 2-D models and experiments.