Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Artificial neural network for simulation of thin liquid films over spinning discs DUNHUI XIAO, KUN ZHAO, OMAR K. MATAR, Imperial College London — In this research the dynamics of a thin film flowing over a rapidly spinning, horizontal disc is considered. A set of non-axisymmetric evolutional equations for the film thickness, radial and azimuthal flow rates are derived using a boundary-layer approximation in conjunction with the Karman-Polhausen approximation for the velocity distribution in the film. The numerical solutions of these highly nonlinear partial differential equations are obtained from a finite difference scheme which are computationally expensive. For this reason, we investigate utilizing the Integral Boundary Layer (IBL) model with a neural network (NN) model to predict the evolution of waves following the simulation of the IBL equations under the same operation condition (e.g. rotational speed, initial flow rate), or even under conditions where the traditional numerical schemes yield no solutions. The NN is trained on a dataset from multiple simulations from the IBL model and then used to simulate film evolution from outside this set. Overall, the resulting model predicts the evolution of waves under the various operation conditions reasonably well when compared with the full numerical solution.

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Date submitted: 18 Sep 2017 Electronic form version 1.4