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Generalized Nematohydrodynamic Boundary Conditions with Application to Bistable Twisted Nematic Liquid Crystal Displays[1]
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Parallel to the highly successful Ericksen-Leslie hydrodynamic theory for the bulk behavior of nematic liquid crystals (NLC), we derive a set of coupled hydrodynamic boundary conditions to describe the NLC dynamics near NLC-solid interfaces. In our boundary conditions, translational flux (flow slippage) and rotational flux (surface director relaxation) are coupled according to the Onsager variational principle of least energy dissipation. The application of our boundary conditions to the truly bistable π-twist NLC cell reveals that the thus far overlooked translation-rotation dissipative coupling at solid surfaces can accelerate surface director relaxation and enhance the flow rate. This can be utilized to improve the performance of electro-optical nematic devices by lowering the required switching voltages and reducing the switching times.

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