Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Open-Channel Capillary Flow in Helical Support Structures[1]
JERRY OELERICH, DAVID THIESSEN, Washington State University — When gravitational effects are negligible compared to capillary effects, it is possible to achieve capillary flow in a helical wire support. The global dynamics of open-channel capillary flow in helical support structures are modeled by one-dimensional continuity and momentum equations where the pressure is related to the local curvature of the free surface. Equal volumetric flow rates at entrance and exit are prescribed. The pressure difference across the interface, or Laplace pressure, is predicted as a function of the helix geometry and contact angle. Local flow analysis (FEM) has been performed to determine viscous losses as a function of the dimensions of the support and the configuration of the free surface, where the free surface shapes are taken to be the equilibrium shapes computed for static conditions. The global model predicts that for a given helix geometry and contact angle and for a given flow rate below a critical value, there exists a range of channel volumes that give a stable flow. Preliminary experimental evidence suggests that a channel with an imposed flow rate can adjust its volume to achieve stable flow.

[1]Supported by NSF.

David Thiessen
Washington State University

Date submitted: 04 Aug 2008 Electronic form version 1.4