



Virginia Commonwealth University
VCU Scholars Compass

Biology and Medicine Through Mathematics
Conference

2023

May 17th, 11:00 AM - 11:20 AM


A long-wave model for film flow inside a tube with slip

Mark S. Schwitzerlett
msschwitzerl@vcu.edu

Ihsan Topaloglu
Virginia Commonwealth University, iatopaloglu@vcu.edu

H. Reed Ogrosky
Virginia Commonwealth University, hrogrosky@vcu.edu

Follow this and additional works at: <https://scholarscompass.vcu.edu/bamm>

 Part of the [Life Sciences Commons](#), [Medicine and Health Sciences Commons](#), and the [Physical Sciences and Mathematics Commons](#)

<https://scholarscompass.vcu.edu/bamm/2023/wed/1>

This Event is brought to you for free and open access by the Dept. of Mathematics and Applied Mathematics at VCU Scholars Compass. It has been accepted for inclusion in Biology and Medicine Through Mathematics Conference by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.

Viscous liquid film flows in a tube arise in numerous industrial and biological applications, including the transport of mucus in human airways. Previous modeling studies have typically used no-slip boundary conditions, but in some applications the effects of slip at the boundary may not be negligible. We derive a long-wave model based on lubrication theory which allows for slippage along the boundary. Linear stability analysis verifies the impact of slip-length on the speed, growth rate, and wavelength of the most unstable mode. Nonlinear simulations demonstrate the impact of slip-length on plug formation and wave dynamics. These simulations are conducted for flows driven by gravity, core flow, or a combination of the two. We derive a second long-wave model to explore the effect of slip on fluid flow in a constricted tube. The results of simulations in such a tube will be discussed.