

Progress Report on
“Investigation of viscosity transitions in non-Newtonian fluids”
for the
National Society of Physics Students Undergraduate Research Award
April 30th, 2008

Narrative:

Last fall our group proposed a project looking at viscosity of non-Newtonian fluids for the SPS Undergraduate Research Award. We wanted to more closely examine the relationship between shear stress and shear rate on the fluid and try to characterize whether or not the fluid undergoes something similar to a phase transition between liquid-like and solid-like behavior.

We have spent this semester building our apparatus to measure the viscosity of non-Newtonian fluids. This has been a very valuable experience since we had to design and build the apparatus. The main setup consists of a stepper motor rotating a cylinder containing our fluid. There is also a smaller cylinder inside which is dragged along by the rotating fluid. Rotary motion sensors measure the rotational speed of the outside (driven) cylinder and the torque on the inside (dragged) cylinder. By looking at the speed and torque of the cylinders, we can determine viscosity. For this project we needed to familiarize ourselves with LabView, since that is how the stepper motor and the rotary motion sensors will be controlled.

We are currently in the final stretch in the assembly of the apparatus and will be collecting data soon. The stage has been built, the sensors and motors have been installed and the LabView program has been completed. The issues that have arisen are from an off-balanced reservoir and the spring system for measuring the torque. We have come to the conclusion that the bond between the material forming the base and the acrylic, hollow cylinder used as a cornstarch reservoir were set a little off. This causes the tube to display visible tremors when the motor is turned on. We are currently working to find a solution that will not result in the disposing of the reservoir. In terms of the spring system, the springs we were intending to use will not work and will be replaced by a torsion spring instead. In the final weeks of the semester, we will begin collecting data. We hope to summarize our data and analysis on a poster, so that our work can be presented at conferences such as the annual SPS Zone 18 Meeting or the $\Sigma\Pi\Sigma$ Quadrennial Congress. Thank you for your generous support of our project.

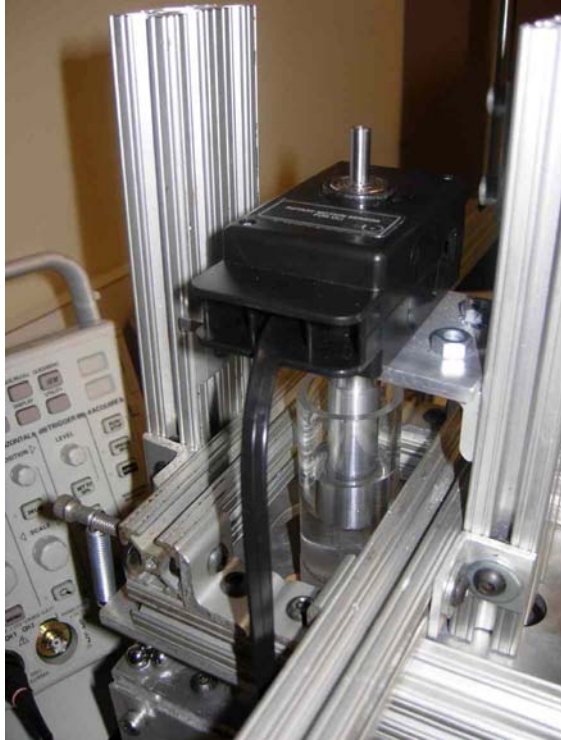


Figure 1: Close-up of Apparatus

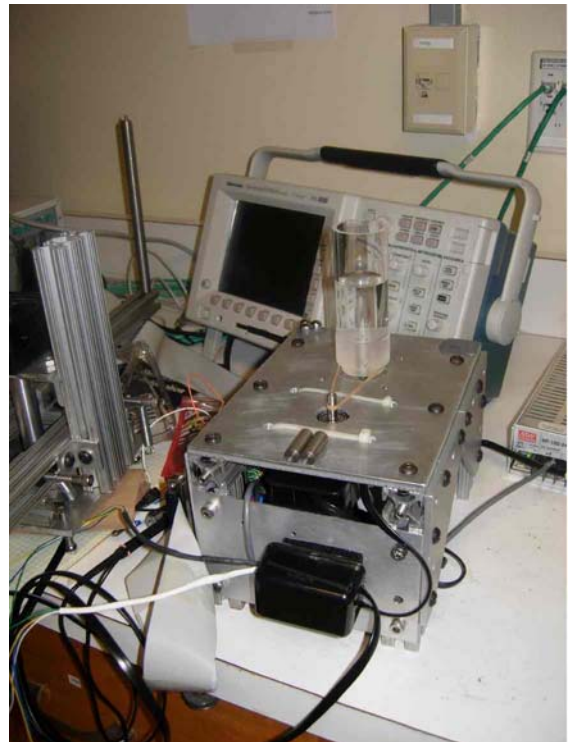


Figure 2: Bottom section of Apparatus

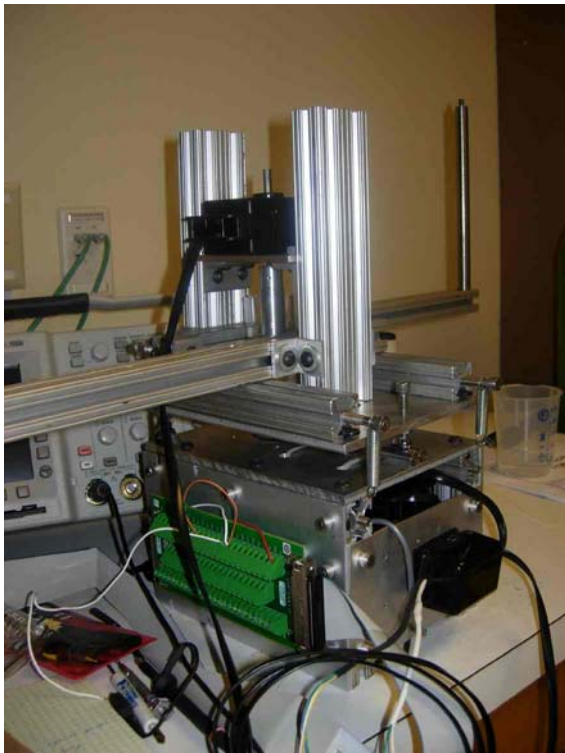


Figure 3: Apparatus

Spending Summary:

Date	Description	Amount
2/1/08	National Instruments - cable & block	(\$495.44)
2/1/08	PASCO - rotary sensor	(\$221.43)
2/1/08	Omega - power supply	(\$149.57)
2/1/08	Stepper3LLC - stepper motor	(\$67.10)
2/28/08	deposit - award check	\$1,040.00
4/18/08	hardware & supplies	(\$18.85)
	balance	\$87.61

The remaining funds will be spent shortly for non-Newtonian fluids.

Respectfully submitted,

Tiara Norris
Society of Physics Students
Department of Physics
California State University, Chico