Applied Mathematical Modeling of Continuous Dynamic Systems of Fluids in Pipe Flows

DeForge, Anne (School: Liberty High School)

The purpose of my research and project is to create a dynamical comprehensive mathematical model that represents the flow of non-Newtonian polymeric fluids through a pipe. For industries from materials science to medicine, the manufacturing processes is optimized by an understanding of how fluids behave under an applied force, non-Newtonian fluids in particular can be greatly affected by such processes. A mathematical model that enables both numerical analysis and in depth visualization greatly benefits industries that would otherwise spend time, materials, and labor on physical trials to gain understanding. My project intends to create a method for developing a continuous and dynamic model that describes laminar flows given only one known characteristic, the viscosity. A procedure was developed to experimentally determine the viscosity of the fluid, and then simplified the unsteady partial differential form of the Navier-Stokes equation to using the calculated viscosity parameter to model the motion, and finally preformed a data -validation through physical simulations of pipe flows.

Awards Won:

Mu Alpha Theta, National High School and Two-Year College Mathematics Honor Society: First Award of $ 1,500