**FLOW OF FLUIDS IN TUBES**

**Main Equation**

****

1. Newtonian Fluid()(Hagen-Poiseuille Equation)

****

1. Power Law Fluid ()



1. Bingham Fluid ()

**** If 

**** If 

**Shear Stress and Shear Rate at the Wall**

****



**Friction Factor Concept**

****

****

**** *Laminar Flow*

****

**Velocity Profile**

*Newtonian Fluids*

****

****

****

*Power-law fluids*

****

****



**Some Rheological Models**











****

*For Power-law fluids*

****

****

**Balance of Mechanical Energy (between locations 1 and 2)**



****

**ROTATIONAL VISCOMETRY**

**CONCENTRIC-CYLINDERS**

* **Newtonian/Non-Newtonian Fluids**











where m is the slop of a log  versus log M plot





* **Plastic Fluids (Bingham)**

If  and (all the sample in the gap is sheared)









If (sheared and non-sheared regions exist)







**CONE AND PLATE**

****

****

**PARALLEL PLATES**

* For any fluid

****

****

****

* For Power Law and Newtonian fluids





