ÉTS ÉCOLE DE TECHNOLOGIE SUPÉRIEURE
Le génie pour l'industrie
Université du Québec

Running DualSPHysics on Linux

Research Directors:

Professor Vincent Demers

Professor Louis Dufresne

Presented by:

Mohammad Meiabadi

Montréal, December 16 2020

8th follow up meeting

Outline

- How to Run DualSPHysics on Linux
- Permissions to Run DualSPHysics
- Mathematical Solution of Ratio Equation
- Simulation of Poiseuille Flow of Power Law Fluid by Linux

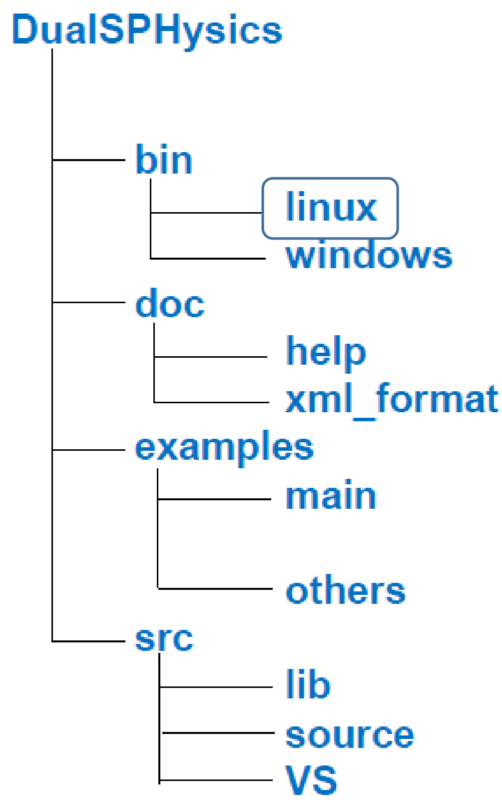
ÉTS ÉCOLE DE TECHNOLOGIE SUPÉRIEURE
Le génie pour l'industrie Université du Québec

Permissions to Run DualSPHysics

To run DualSPHysics on Linux we need to allow permissions:

1. chpermissions.sh (once)
2. DualSPHysics5.0_NNewtonianCPU_linux64 (once)
3. GenCase_linux64 (once)
4. PartVTKOut_linux64 (once)
5. MeasureTool_linux64 (once)
6. xCasePoiseuilleNNlinux64CPU.sh (each case)

Post- processing files (items 4 and 5)

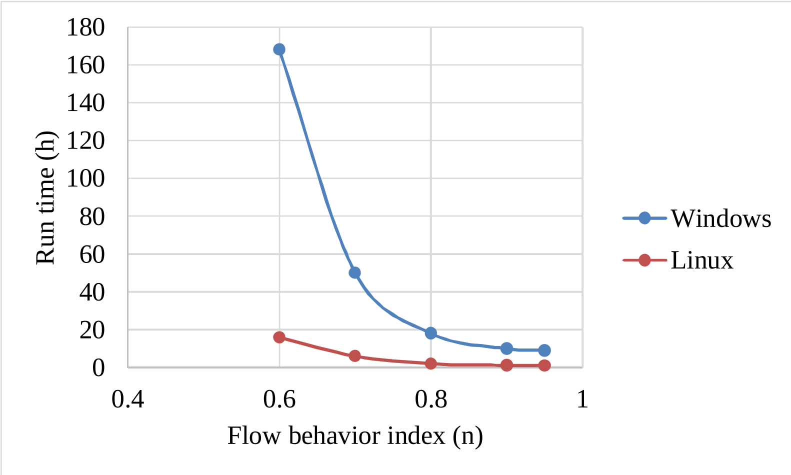


Steps to Run DualSPHysics on tftcfd-01 Station

1. Transfer case files from Windows to Linux
2. Set execute permission on xCasePoiseuilleNNlinux64CPU.sh
3. Run the sh script by Linux
4. Transfer CasePoiseuilleNN_out from Linux to Windows
5. Analysis of results by ParaView in Windows

Comparison Linux and Windows

	Windows	Linux	Windows	Linux	Windows	Linux	Windows	Linux	Windows	Linux
Flow behaviour index	n=0.95		n= 0.9		n= 0.8		n=0.7		n=0.6	
Flow consistency index	m= 0.001		m= 0.001		m= 0.001		m= 0.001		m= 0.001	
ΔP/L	10		10		10		10		10	
Time of simulation(s)	1		1		1		1		1	
IDP /Thickness	0.02		0.02		0.02		0.02		0.02	
Number of particles	2550		2550		2550		2550		2550	
Run time (h)	9	1	10	1.2	18	2	50	6	1week	16



Mathematical Solution of Ratio Equation

The shear rate is

$\dot{\gamma}(y) = \frac{-dv_z}{dy}$, for Power law fluid $\dot{\gamma}(y) = \left[\frac{-\Delta p}{Lm}\right]^{\frac{1}{n}} \left(y^{\frac{1}{n}}\right)$

The Ratio of actual viscosity over Newtonian viscosity is

$$Ratio = \frac{\eta}{m} = \frac{m\dot{\gamma}^{n-1}}{m} = \dot{\gamma}^{n-1} = \left[\frac{-\Delta p}{Lm}\right]^{\frac{n-1}{n}} \left(y^{\frac{n-1}{n}}\right)$$

$$1 = \left[\frac{-\Delta p}{Lm}\right]^{\frac{n-1}{n}} \left(y^{\frac{n-1}{n}}\right)$$

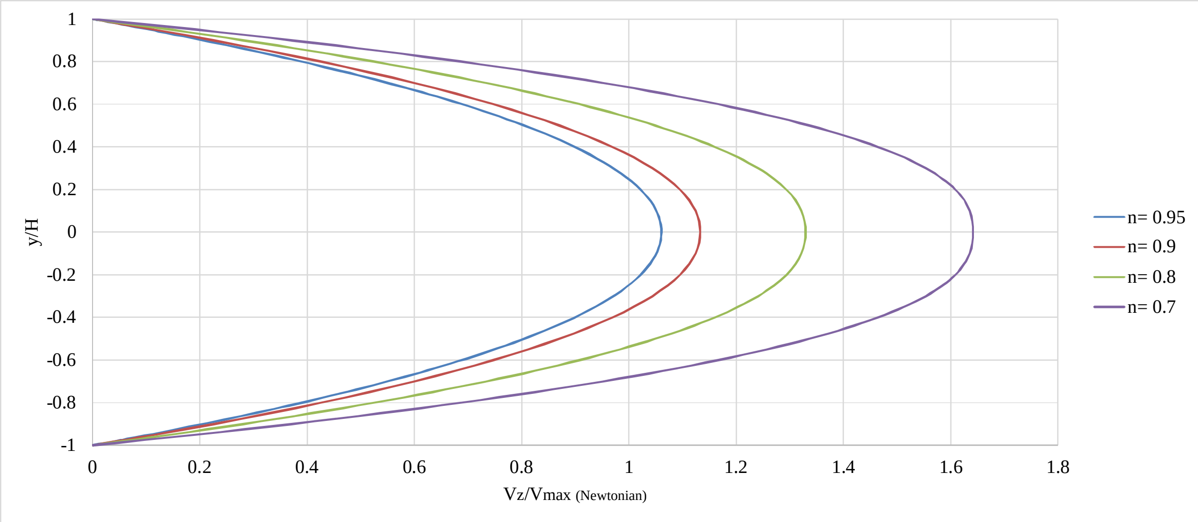
For the following parameters:

$m = 0.001$, $\frac{-\Delta p}{L} = 10$, $H = 0.0005$

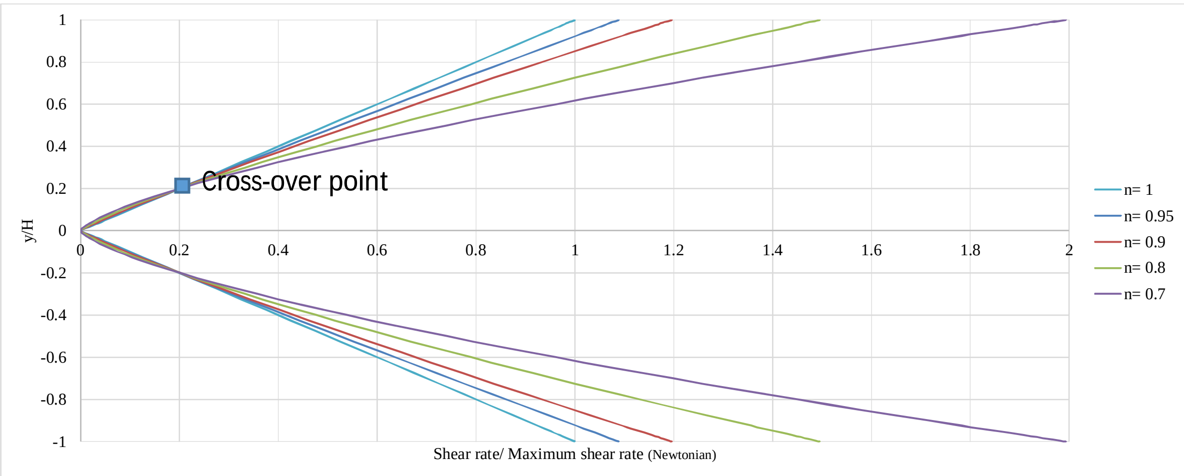
Having solved the Ratio equation we reach to the height of cross-over point:

$y = 0.00001$, $\frac{y}{H} = 0.2$

Velocity and Shear Rate Profiles

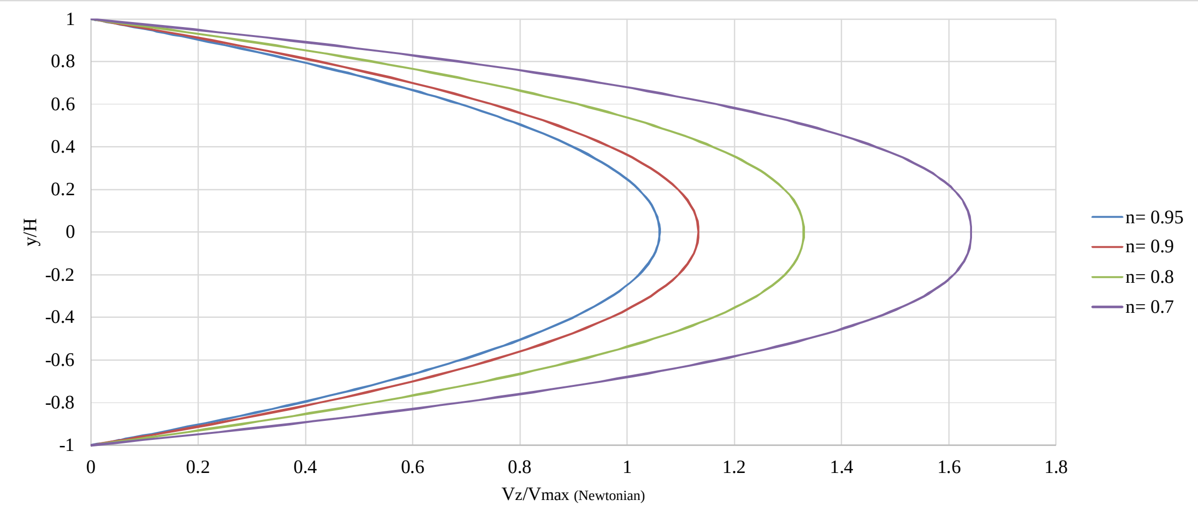


- $H = 0.0005, \quad m = 0.001, \quad \frac{-\Delta p}{L} = 10$
- $n = 1 \rightarrow v_{z_{max}} = 1.250 \times 10^{-3}$
- $n = 0.95 \rightarrow v_{z_{max}} = 1.325 \times 10^{-3}$
- $n = 0.9 \rightarrow v_{z_{max}} = 1.416 \times 10^{-3}$
- $n = 0.8 \rightarrow v_{z_{max}} = 1.661 \times 10^{-3}$
- $n = 0.7 \rightarrow v_{z_{max}} = 2.051 \times 10^{-3}$

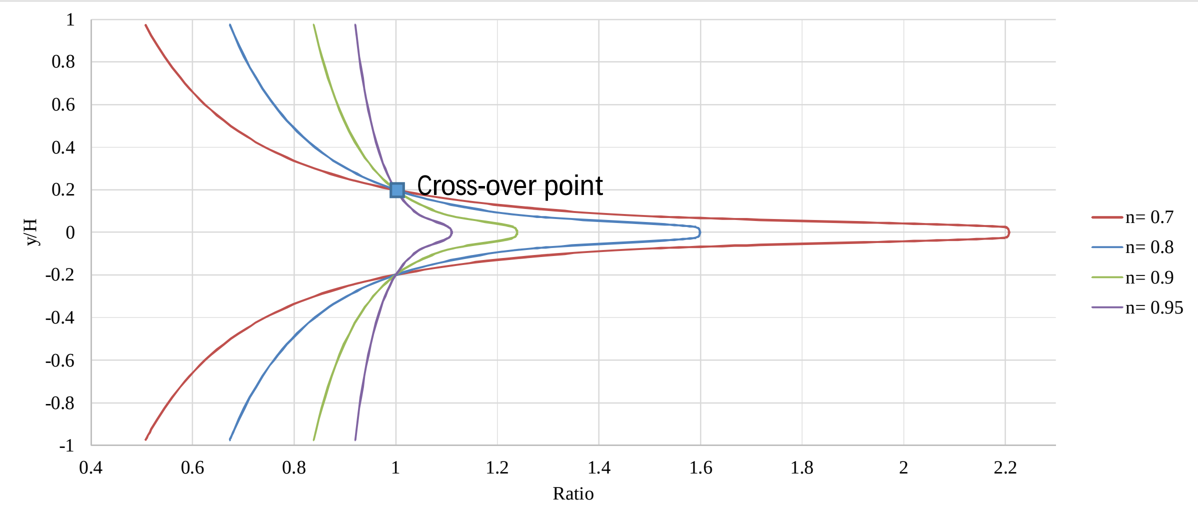


$0 > \frac{y}{H} > 0.2 \rightarrow$ Shear rate of Newtonian fluid $>$ Shear rate of non – Newtonian
$0.2 < y/H < 1 \rightarrow$ Shear rate of Newtonian fluid $<$ Shear rate of non – Newtonian

Velocity and Ratio Profiles



- $n = 1 \rightarrow v_{z_{max}} = 1.250 \times 10^{-3}$
- $n = 0.95 \rightarrow v_{z_{max}} = 1.325 \times 10^{-3}$
- $n = 0.9 \rightarrow v_{z_{max}} = 1.416 \times 10^{-3}$
- $n = 0.8 \rightarrow v_{z_{max}} = 1.661 \times 10^{-3}$
- $n = 0.7 \rightarrow v_{z_{max}} = 2.051 \times 10^{-3}$



$0 > y/H > 0.2 \rightarrow$ Viscosity of Newtonian fluid $<$ Viscosity of non – Newtonian

$0.2 < y/H < 1 \rightarrow$ Viscosity of Newtonian fluid $>$ Viscosity of non – Newtonian