Particles in a Periodic Double Shear Flow - Physics Setup

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Physics Setup

Please watch the following videos for a demonstration of steps for Physics Setup in Fluent:

Physics Setup Part 1:

Before watching this tutorial video, please download the injection file: injection_onlyatshear400.inj

Quick Summary of the points covered in the video above:

- Define Injections
- Change material properties (density and viscosity)
- Apply periodic boundary conditions
- Write case and data

Physics Setup Part 2:

Before watching this video, please download the files needed in this case:

Initial velocity field data file: IC.dat

User Defined Function (UDF) for reading the data file into FLUENT: define_init.c

Case file, Data file and compiled UDF library (download this if you have trouble compiling UDF): Case and data and compiled UDF.zip

Quick Summary of the points covered in the video above:

- Display mesh
- Compile UDF
- Initialize case
- Write 3 cases for the flow of 3 different stokes number.

Physics Setup Part 3:

There is an ERROR in the DENSITY VALUE given in the video. Please use the density values given in the table below instead!

The Density to use for three different cases:

Stokes Number	Density
St = 0.2	2.056
St = 1	10.28
St = 5	51.399

How to find the density from Stokes Number?

As we have discussed in the Pre-analysis and Setup section, Stokes Number is the ratio of particle response time to the flow characteristic time scale. Here, in the case of low Reynolds Number flow, particles response time is calculated using this formula:

$$\tau_p = \frac{\rho D^2}{18\mu}$$

Here, we will use the inverse of the instability growth rate as the flow characteristic time scale:

$$\tau_f = \frac{1}{\varsigma} = \frac{1}{0.1751s^{-1}}$$

Thus combining the two equations above, we get:

$$St = \frac{\tau_p}{\tau_f} = \tau_p \varsigma = \frac{\rho D^2}{18\mu}\varsigma$$

$$\Rightarrow \rho = \frac{18\mu \cdot St}{D^2 \varsigma}$$

Go to Step 5: Numerical Solution

Go to all FLUENT Learning Modules