

# Fluid Mechanics I

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## Bonus Homework 2

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Welcome to your 2<sup>nd</sup> Python programming HW!

In this assignment, you will be tasked with writing a Python code in Jupyter Notebook or any other Integrated Development and Learning Environment (IDLE) to solve a first-order differential equation that models the behavior of falling particles in a fluid, specifically under the assumption of the Stokes region.

The Stokes region refers to a regime in fluid dynamics where the viscous forces dominate over inertial forces. This assumption simplifies the governing equations and allows for a more straightforward analysis of the particle's motion in the fluid.

Note that you will need to numerically solve the differential equation using Python. You can achieve this by utilizing ODE solvers from the scipy library, such as "odeint" and "solve\_ivp", or by implementing your own numerical method like Euler's Method.

### *Problem:*

A particle of 4 mm diameter and density of  $2700 \text{ kg/m}^3$  is falling freely from rest in an oil of  $678 \text{ kg/m}^3$  density and  $0.3 \text{ kg/(m.s)}$  viscosity. Assuming that Stokes' law applies:

- Plot the distribution velocity of the particle in terms of time.
- How long will the particle take to reach 99 per cent of its terminal velocity?

Good Luck