

MAE4230/5230

Intermediate Fluid Dynamics

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Lecture 3

- Course website update/announcement
- G. I. Taylor's lecture

Low Reynolds Number Flows

Stokes Flow

$$Re \ll 1$$

Fluid inertia \ll Viscous Force

Pressure force
balances the Viscous Force

STATICS

Low Reynolds number flow

- History independent
- Time reversible

G. I. Taylor's Lecture

curious phenomena at low Reynolds numbers

- <http://web.mit.edu/hml/ncfmf.html>

Low Reynolds number Flows

Stokes flow

- **History independent:** flow velocity is determined by the forces and the boundary velocity at the same instance
 - **Time reversible:** if we play a film of the Stokes flow, we won't be able to tell whether it is played forward or backward. time does not come in explicitly.
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- **Stokes Drag on a Sphere:**
linear in velocity, the density, and the size of the sphere
 - **Approximated Drag on a Slender body:**
roughly, the normal force is twice the tangential force