

Today:

Admin

Finish First Assignments

Start Overview: Choices in imaging

Admin:

The undergraduate engineering section (MCEN 4151) is oversubscribed. If you are on the waitlist for that section, chances are not good.

Your chances are not bad if you are on the wait list for MCEN 5151, FILM 4200 or ARTF 5200.

Put signed Use Agreement, Syllabus Agreement, on piles up front.

Reminder, ITLL orientations: For after-hours access and computer login, attend a 1/2 hr tour. Find out what resources are here, agree to not spill drinks on the keyboards. M-Th 5:05 pm, in front of the ITLL office next door. Reservations recommended but not required.

Lecture notes will be posted on the Flow Vis site. Feel free to nag me.

First Assignments

<http://www.colorado.edu/MCEN/flowvis/course/initialassignments.pdf>

Overview 1: Topics will be presented iteratively.

Previsualization: Have a goal, think about what you want it to look like.

Make CHOICES:

1. Flow phenomenon: Water boiling? Faucet dripping?
2. Visualization technique: Add dye? See light distorted by air/water surface?
3. Lighting (source of worst image problems)
4. Image acquisition: Still? Video? Stereo? Time lapse? High speed?
5. Post processing, final output. Edit, at least crop the image, consider contrast.

1. Flow phenomenon: Why does it look like that?

What are the forces? = a framework for interpretation of the image

Minute paper. In groups (3 or so) list all the forces that can act on a fluid.

Write on a scrap of paper.

1. **Flow phenomenon: Why does it look like that?**

What are the forces? = a framework for interpretation of the image

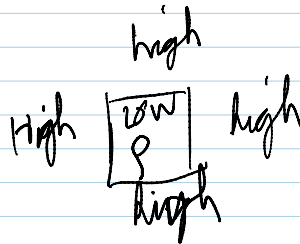
Minute paper results:

Viscous
Shear
Gravitational
Buoyancy
Magnetic
Inertial
Centripetal/centrifugal
Pressure ←
Body forces: gravity, buoyancy, EM
Viscosity, shear, friction
Thermal diffusivity
Interaction with other fluids
Surface tension

Air resistance
Cohesion
Adhesion (capillary action)
Normal force
Stress ←
Strain ←
Thermodynamic ←
Electro-magnetic
Compressible →
Heat ←
Convection ←
Osmosis ←
Solar radiation

Composition of fluids
Densities of fluids ←
Chemical reactions ←
Impact ←
Wind →
Mass ← *NOT a force*
Acceleration ←
Temperature →
Phase change ←
Strong, weak nuclear forces
Cavitation
Vortex structures →
vortex stretching →
concentration gradient ←

↓
Marangoni forces



Good, inclusive list. Not all are forces, but all can 'drive' a flow via a set of physics or mechanism.
Heat, for example.

All forces can be categorized like this: 2 flavors of forces

←
Body

Acts on every molecule equally

- a) Gravity
- b) Electromagnetics

<http://www.youtube.com/watch?v=fAbycqD2UmQ>

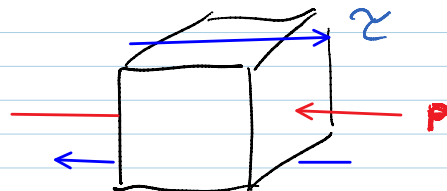
Protrude Flow
Ferromagnetic fluid (ferrofluid). Iron nanoparticles suspended in oil, follows magnetic field lines.

http://www.colorado.edu/MCEN/flowvis/galleries/2010/Team-2/FV_popup1-16.htm

Expensive, but you don't need much (\$30)
Check Ebay, Craig's list

↓
Surface

Acts on the surface of a volume of fluid



P Pressure: always perpendicular to surface

τ Shear: always parallel to surface

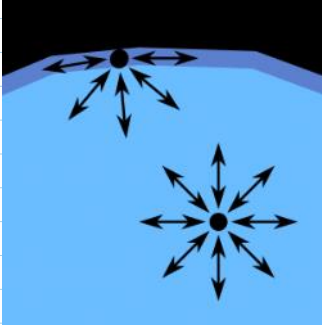
Any surface force can be decomposed into a shear plus pressure

Note: these are actually STRESSES = Force acting on an area.

The only force that is not so easily categorized is SURFACE TENSION

It's the result of intermolecular forces, so it

THE ONLY FORCE THAT IS NOT SO EASILY CATEGORIZED
IS SURFACE TENSION



It's the result of intermolecular forces, so it affects every molecule, like a body force

But it is only obvious at interfaces between fluids, kind of like a surface force.

<http://upload.wikimedia.org/wikipedia/commons/thumb/f/f9/Wassermolek%C3%BCleInTr%C3%B6pfchen.svg/300px-Wassermolek%C3%BCleInTr%C3%B6pfchen.svg.png>

<http://www-math.mit.edu/~dhu/Striderweb/striderweb.html>

Water-walking insects

Conclusion: Whenever you are observing fluids, list the forces that may be acting, ***that make it look like that.***

Examples? Let's look at

<http://fuckyeahfluidynamics.tumblr.com/>

