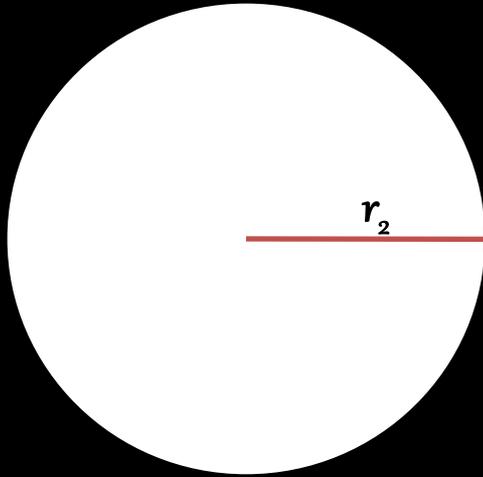
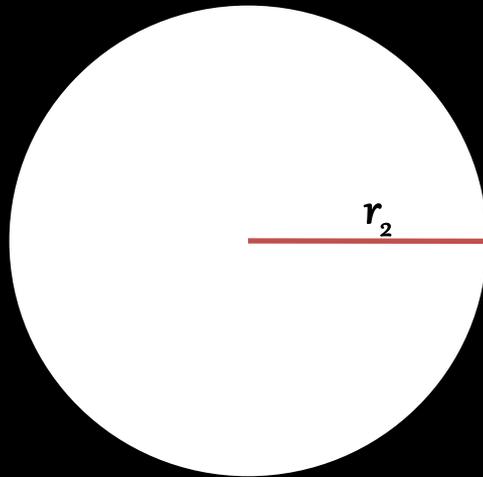


$$\text{Radius} = r_1 = 3$$

$$\text{Circumference} = 2\pi r_1 \approx 19$$

$$\text{Area} \approx 28$$

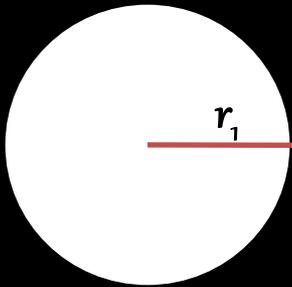




Radius = $r_1 = 4$

Circumference = $2\pi r_1 \approx 25$

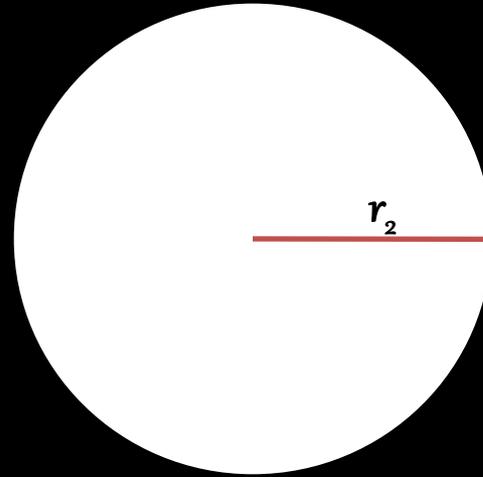
Area ≈ 50



$$\text{Radius} = r_1 = 3$$

$$\text{Circumference} = 2\pi r_1 \approx 19$$

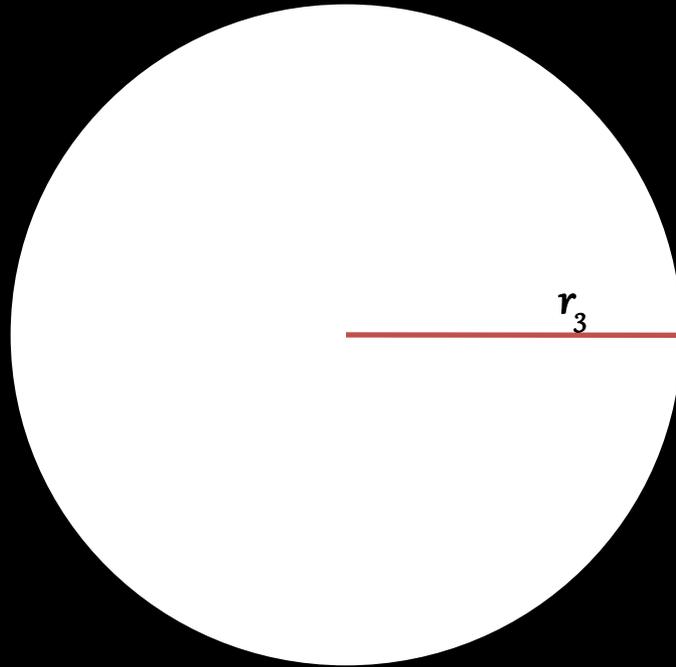
$$\text{Area} \approx 28$$



$$\text{Radius} = r_1 = 4$$

$$\text{Circumference} = 2\pi r_1 \approx 25$$

$$\text{Area} \approx 50$$



*As the area increases so does
the circumference.*



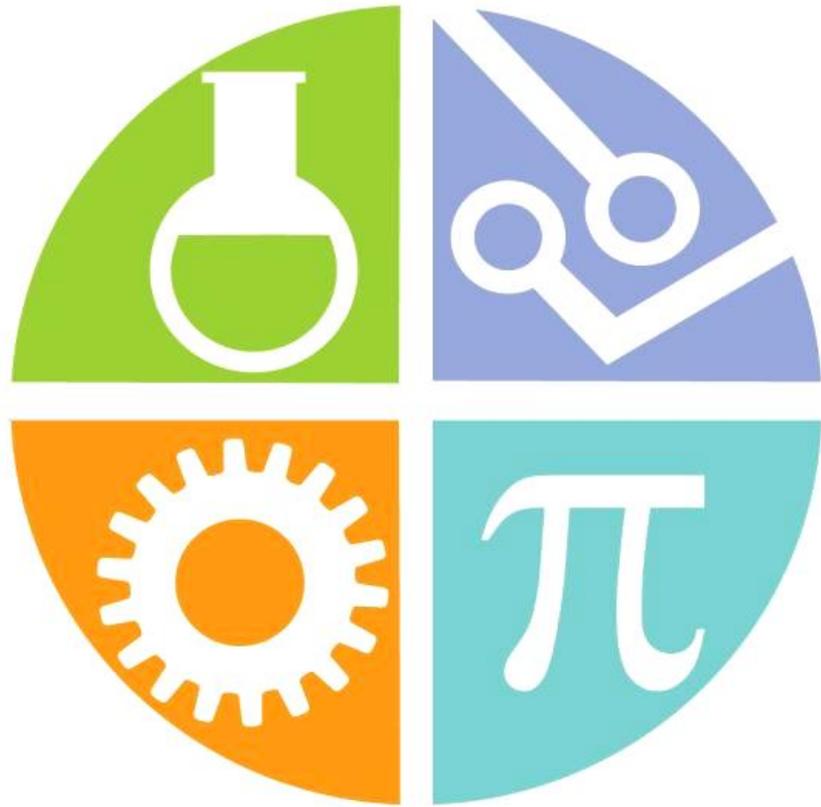
As the circle of our knowledge expands, so does
the circumference of darkness surrounding it.

- *Albert Einstein*

CBCT: CS 535

Introduction to Scientific Computing

Zubin Bhuyan,
Department of CSE, Tezpur University
<http://www.tezu.ernet.in/~zubin>



The GOAL is to address the needs of the students of:

Science

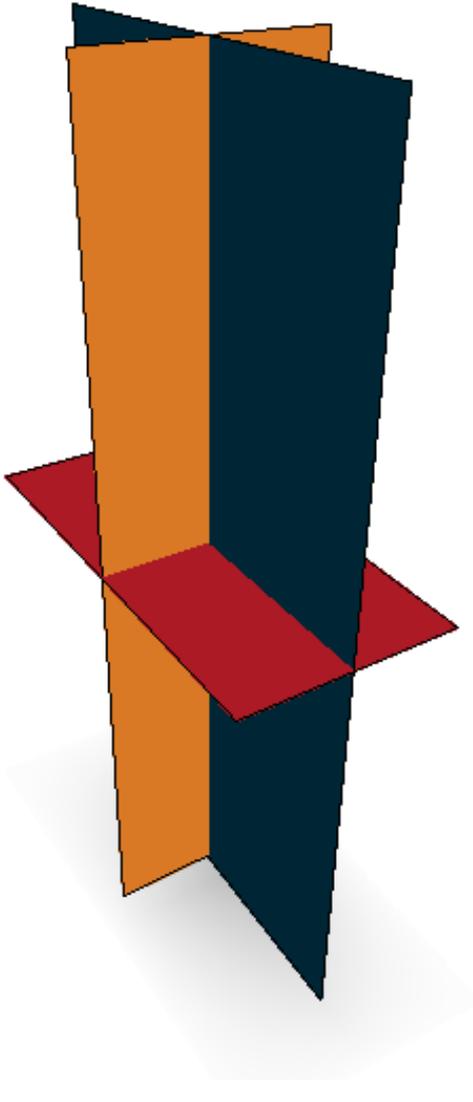
Technology

Engineering

Mathematics

Computational fluency for all

- ✓ 1. Basic Computing
2. Data Analysis
3. High Performance Computing



Prerequisites

- Linear algebra
- Differential equations

Although it is not mandatory, it will be helpful if the students have a working knowledge of a programming language.

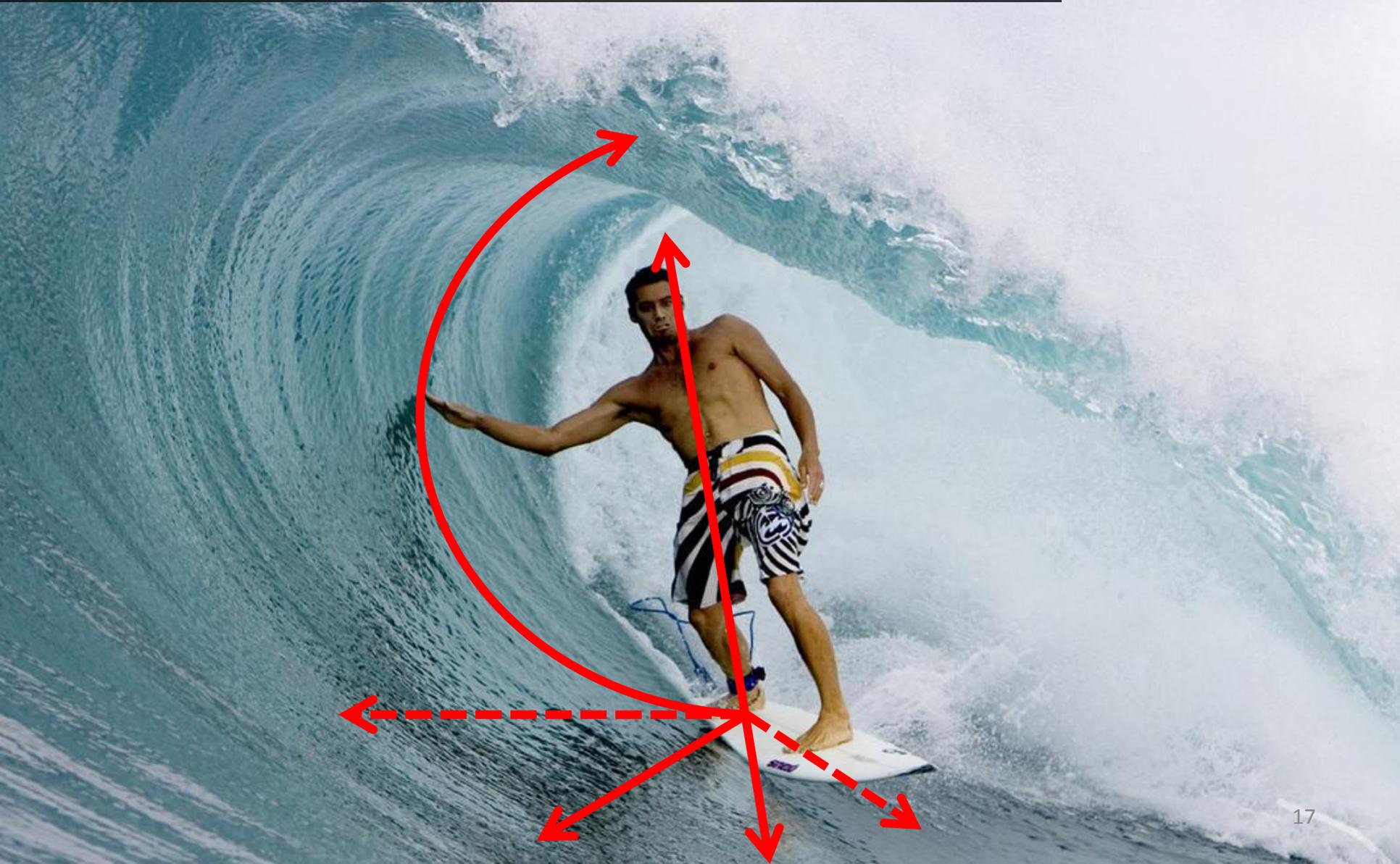
"When you're programming you are teaching, possibly the stupidest thing in the universe - a computer, how to do something."

-Gabe Newell



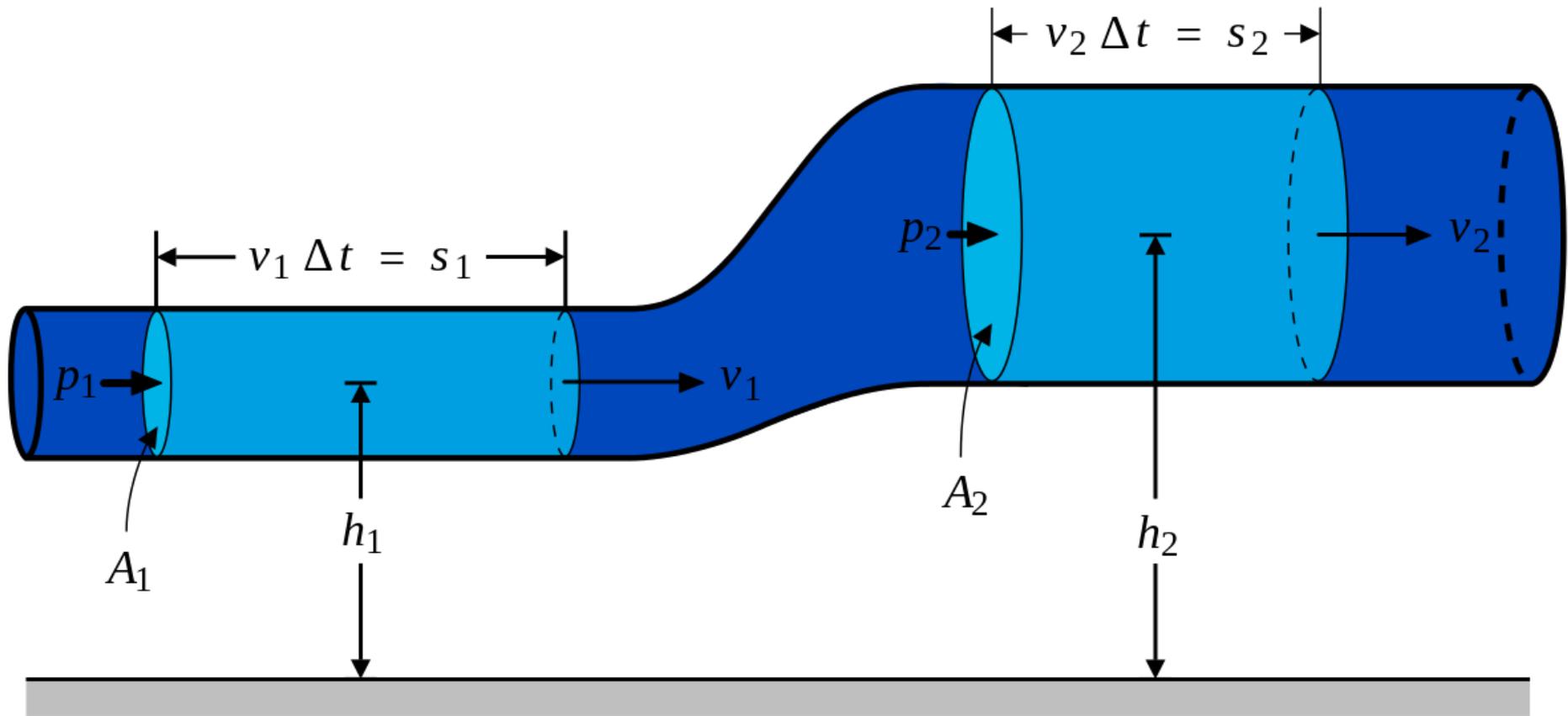
We'll learn about common PROBLEMS, and try to understand them.

And then we'll tackle them!



And then we'll tackle them!





Continuum mechanics is a branch of mechanics that deals with the analysis of the kinematics and the mechanical behaviour of materials modelled as a continuous mass rather than as discrete particles.^[Wikipedia]

$$\rho \left(\frac{\partial u}{\partial x} + u \cdot \nabla u \right) = -\nabla p + \nabla \cdot \tau + f$$

Navier–Stokes equations

The general form of the equations of fluid motion is

$$\rho \left(\frac{\partial \mathbf{u}}{\partial t} + \mathbf{u} \cdot \nabla \mathbf{u} \right) = -\nabla p + \nabla \cdot \boldsymbol{\tau} + \mathbf{f}$$

\mathbf{u} is the flow velocity,

ρ is the fluid density,

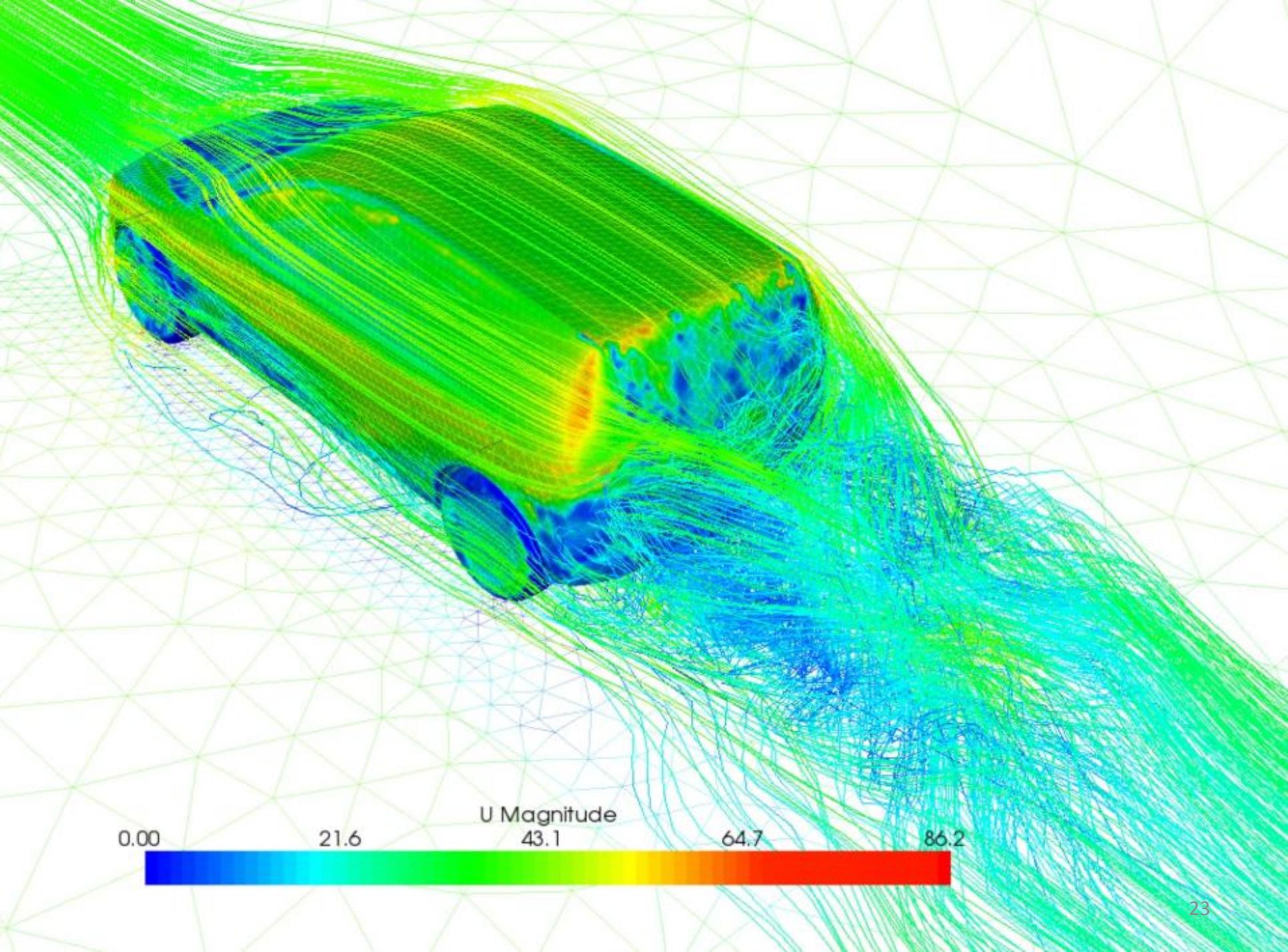
p is the pressure,

$\boldsymbol{\tau}$ is the (deviatoric) component of the total stress tensor, which has order two,

\mathbf{f} represents body forces (per unit volume) acting on the fluid,

∇ is the del operator.

$$\begin{aligned}
& \rho \left(\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} + w \frac{\partial u}{\partial z} \right) = \\
& \rho g_x - \frac{\partial p}{\partial x} + \frac{\partial}{\partial x} \left[2\mu \frac{\partial u}{\partial x} + \lambda \nabla \cdot \mathbf{V} \right] + \frac{\partial}{\partial y} \left[\mu \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right) \right] + \frac{\partial}{\partial z} \left[\mu \left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z} \right) \right] \\
\hline
& \rho \left(\frac{\partial v}{\partial t} + u \frac{\partial v}{\partial x} + v \frac{\partial v}{\partial y} + w \frac{\partial v}{\partial z} \right) = \\
& \rho g_y - \frac{\partial p}{\partial y} + \frac{\partial}{\partial y} \left[2\mu \frac{\partial v}{\partial y} + \lambda \nabla \cdot \mathbf{V} \right] + \frac{\partial}{\partial z} \left[\mu \left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y} \right) \right] + \frac{\partial}{\partial x} \left[\mu \left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} \right) \right] \\
\hline
& \rho \left(\frac{\partial w}{\partial t} + u \frac{\partial w}{\partial x} + v \frac{\partial w}{\partial y} + w \frac{\partial w}{\partial z} \right) = \\
& \rho g_z - \frac{\partial p}{\partial z} + \frac{\partial}{\partial z} \left[2\mu \frac{\partial w}{\partial z} + \lambda \nabla \cdot \mathbf{V} \right] + \frac{\partial}{\partial x} \left[\mu \left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z} \right) \right] + \frac{\partial}{\partial y} \left[\mu \left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y} \right) \right]
\end{aligned}$$



0.00

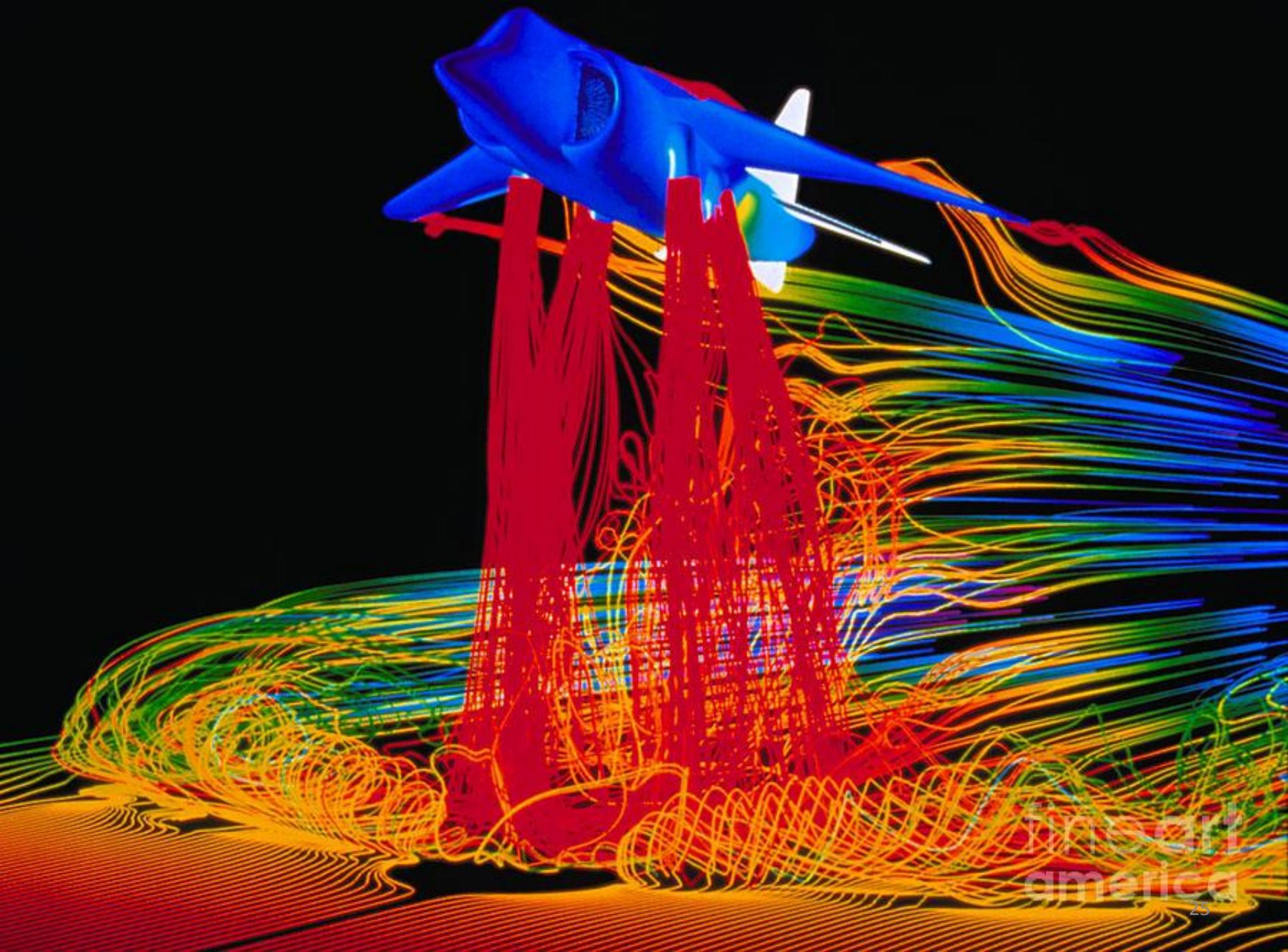
21.6

U Magnitude
43.1

64.7

86.2

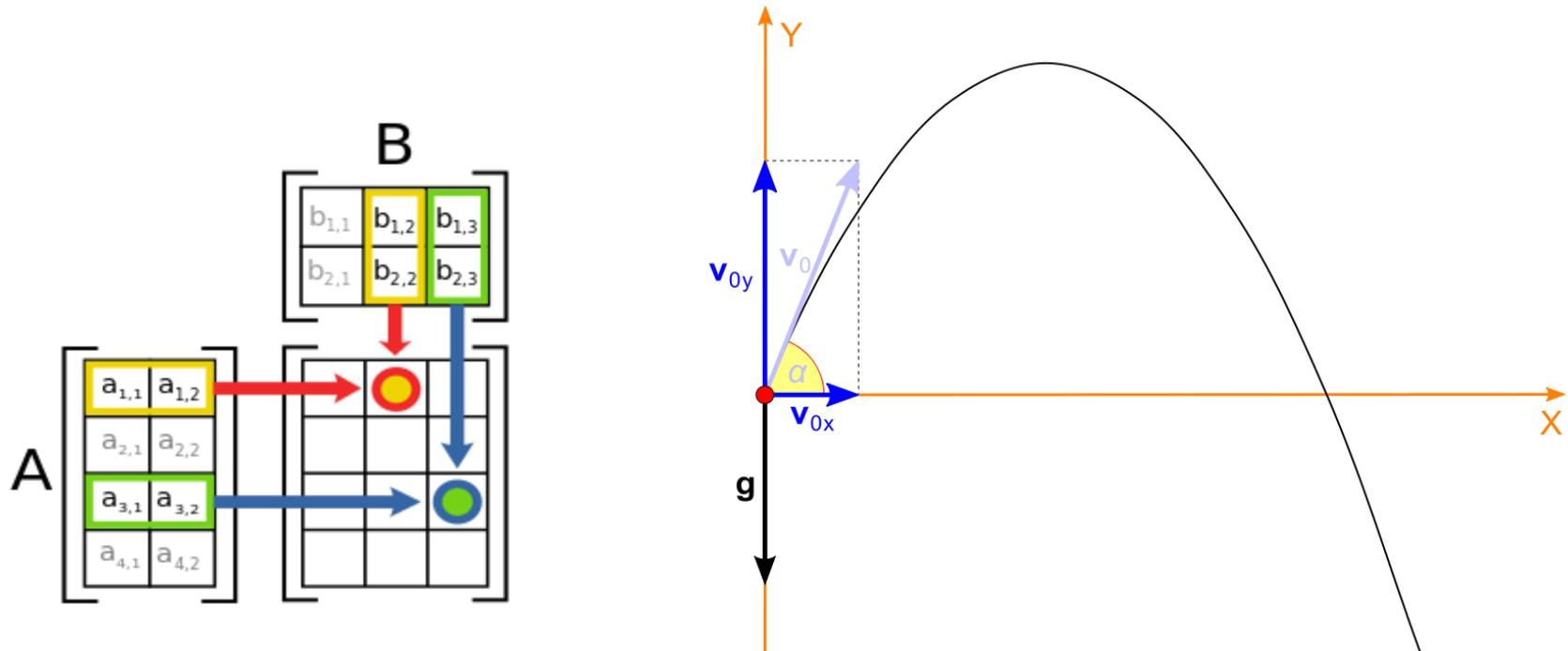




travel
america

Fret not,

For we'll be dealing with simple subjects, like....



A topics to be covered in this course

- Random and Pseudo number generation
- Solving simple linear equation systems
- Discrete and Continuous Modeling
- Interpolation
- Newton–Raphson method (and the like)
- Midpoint, Trapezoidal rule
- Linear Algebra; Gaussian Elimination
- Cluster analysis; Statistical Classification
- A few case studies

Outcome

After completion of this course, you will be able to write programs which are

- ACCURATE
- EFFICIENT
- ELEGANT

You will be able to perform practical implementation of solutions to scientific and engineering problems.

Evaluation

Test no.	Marks	Duration
I	25	30 minutes
II	25	30 minutes
III	40 (Major 1)	60 minutes
IV	25	
V	25	30 minutes
VI	60 (Major 2)	120 minutes
<hr/>		
Total	200	

- All assignments must be submitted by the due date and time.
- Circumstances necessitating the absence have to be established with proper documentation, and have to be approved by the DAC.