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### Course Online Resources

- ▶ Socrative in-class student response
- ▶ Piazza for class Q&A and online discussion https://piazza.com/



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### Socrative

- ▶ Go to: <u>http://m.socrative.com</u>
- Room number : 75443
- Short answer
- What is Computational Fluid Dynamics?





# Computational fluid dynamics

From Wikipedia, the free encyclopedia

**Computational fluid dynamics**, usually abbreviated as **CFD**, is a branch of fluid mechanics that uses numerical methods and algorithms to solve and analyze problems that involve fluid flows. Computers are used to perform the calculations required to simulate the interaction of liquids and gases with surfaces defined by boundary conditions.

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### Socrative

- Short answer
- What basic knowledge is needed for CFD?





ME 702 - Computational Fluid Dynamics (LBarba)
Lecture O - <u>Review</u> : Differential form of the Fluid Eques. 1) Conservation of Mas

C	onservation of Momentum
	ME F02 - Computational Fluid Dynamics (Learba) Lecture & - Reviews: Differential form of the Fluid Equations
	2) Conservation of Momentum;
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Programming			
▶ Python for scientific co	omputing		
Python distribution			
	http://www.enthought.com/		
NumPy	http://docs.scipy.org/doc/numpy/reference/		
& matplotlib	http://matplotlib.sourceforge.net/		
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Assessment No exams ▶ Presentations echaqucha Might BU College of Engineering 12

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Computational Fluid Dynamics – ENG ME702 – Video View More from this Provider by Lorena A. Barba, Boston University To listen to an audio podcast, mouse over the title and click Play. Open iTunes to download and subscribe to iTunes U collections.										
Description There are many situations in which a computational approach is the ideal one for studying a problem. For example, in studying the flow of air in the breathing tract of a human, one can hardly do experiments! And even if we could be used by the studying and the studying and the studying and the studying a problem. For example, in studying the flow of air in the breathing tract of a human, one can hardly do experiments? And even if we could be used to a studying a myriad ways. Computational Fluid Dynamics (CFD) is vital for many applications of science and engineering. This course is designed for graduate students or advanced undergraduate Professor Lorena A Barba Mechanical Engineering Department Boston University										
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Links										



## **History of CFD**

- ▶ Richardson, 1911
- ▶ Courant, Friedrichs, Lewy, 1928
- ▶ von Neumann, Richtmeyer, 1950
- ▶ Lax, 1954
- IX. The Approximate Arithmetical Solution by Finite Differences of Physical Problems involving Differential Equations, with an Application to the Stresses in a Masonry Dam.

By L. F. RICHARDSON, King's College, Cambridge.

Communicated by Dr. R. T. GLAZEBROOK, F.R.S.

Received (in revised form) November 2, 1909,-Read January 13, 1910.

#### Introduction to CFD

▶ Recall the Navier-Stokes equation

$$\frac{\partial \vec{V}}{\partial t} + \vec{V} \cdot \nabla \vec{V} = -\frac{\nabla p}{\rho} + \nu \nabla^2 \vec{V}$$

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▶ Why is it needed? • system difficult to test through experimentation 16 16

- ▶ Why is it needed?
- quickly test many scenarios, to answer "what if"
- faster or easier than experiment



Simulation of a swimmer wearing a Speedo suit



Simulation of turbulent mixing inside a rotating impeller mixing vessel











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