

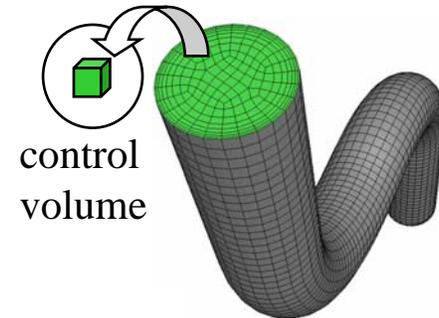
What is CFD?

- ◆ Computational Fluid Dynamics (CFD) is the science of predicting fluid flow, heat and mass transfer, chemical reactions, by solving numerically the set of governing mathematical equations.
Conservation of mass, momentum, energy, species, ...
- ◆ The results of CFD analyses are relevant in:
 - conceptual studies of new designs
 - Product development
 - troubleshooting
 - Redesign
- ◆ CFD analysis complements experimentation and theory.
 - Reduces the total effort required in the experiment design and data acquisition

CFD with Finite Volume Method?

- ◆ Control volumes or Cells.
- ◆ General conservation (transport) equation for mass, momentum, energy, etc.:

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$$\underbrace{\frac{\partial}{\partial t} \int_V \rho \phi dV}_{\text{unsteady}} + \underbrace{\oint_A \rho \phi \mathbf{V} \cdot d\mathbf{A}}_{\text{convection}} = \underbrace{\oint_A \Gamma \nabla \phi \cdot d\mathbf{A}}_{\text{diffusion}} + \underbrace{\int_V S_\phi dV}_{\text{generation}}$$

<u>Eqn.</u>	ϕ
continuity	1
x-mom.	u
y-mom.	v
energy	h

- ◆ Partial differential equations => algebraic equation system
- ◆ Solved numerically