

Acceleration Vector

Engineering Fluid Mechanics

Dr. Kelly Kibler

Department of Civil, Environmental &
Construction Engineering

University of Central Florida



$$\vec{v}(\vec{D}, t) = \frac{d}{dt} (\vec{D}(t))$$

$$\vec{v}(\vec{D}, t) = u \hat{i} + v \hat{j} + w \hat{k}$$

\uparrow $v_x, \frac{dx}{dt}$ \uparrow $v_y, \frac{dy}{dt}$ \uparrow $v_z, \frac{dz}{dt}$

$$\vec{a}(\vec{D}, t) = \frac{d}{dt} (\vec{v}(\vec{D}, t))$$



Acceleration Vector

$$\vec{a}(\vec{D}, t) = \frac{d\vec{V}}{dt} + \underbrace{\frac{\partial \vec{V}}{\partial x}}_u \frac{dx}{dt} + \frac{\partial \vec{V}}{\partial y} \frac{dy}{dt} + \frac{\partial \vec{V}}{\partial z} \frac{dz}{dt}$$

\uparrow
u
 \uparrow
v
 \uparrow
w

$$\vec{a} = \underbrace{\frac{d\vec{V}}{dt}}_{\text{LOCAL ACCELERATION FUNCTION OF TIME}} + \underbrace{u \frac{\partial \vec{V}}{\partial x} + v \frac{\partial \vec{V}}{\partial y} + w \frac{\partial \vec{V}}{\partial z}}_{\text{CONVECTIVE ACCELERATION FUNCTION OF SPACE}}$$

$$\frac{d\vec{V}}{dt} = \text{MATERIAL DERIVATIVE}$$

$$\frac{d\vec{V}}{dt} = \frac{\partial \vec{V}}{\partial t} + (\vec{v} \cdot \nabla) \vec{V}$$



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