MEMS 0071 - Introduction to Fluid Mechanics
Quiz #7

Problem #1

Given the following velocity field, determine the acceleration vector:

$$\vec{V} = 0.4x^2 e^{-0.4t}\hat{\imath}\,[\text{m/s}]$$

The acceleration vector is given as:

$$\begin{aligned}\vec{a} &= \frac{\partial \vec{V}}{\partial t} + u\frac{\partial \vec{V}}{\partial x} + \cancelto{0}{v\frac{\partial \vec{V}}{\partial y}} + \cancelto{0}{w\frac{\partial \vec{V}}{\partial z}} \\ &= \frac{\partial}{\partial t}\left(0.4x^2 e^{-0.4t}\right) + \left(0.4x^2 e^{-0.4t}\right)\frac{\partial}{\partial x}\left(0.4x^2 e^{-0.4t}\right) \\ &= -0.16x^2 e^{-0.4t} + 0.32x^3 e^{-0.8t}\end{aligned}$$