

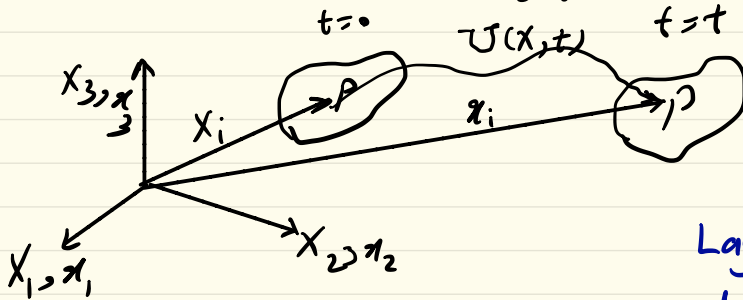
جواب ٩

صانك رسد

بسم الله الرحمن الرحيم

$$\vec{r} = x_i \vec{e}_i \implies \vec{v} = \frac{d\vec{r}}{dt} = \frac{dx_i}{dt} \vec{e}_i \implies v_i = \frac{dx_i}{dt}$$

$$v_i = \frac{dx_i(x,t)}{dt} = \frac{\partial x(x,t)}{\partial t}$$



$U_i(x,t) \equiv$ Displacement Components of point " P "

Lagrangian (material) description

$$x_i(x,t) = X_i + U_i(x,t)$$

$$v_i = \frac{\partial x_i}{\partial t} + \frac{\partial U_i(x,t)}{\partial t} \rightarrow$$

$$v_i(x,t) = \frac{\partial x_i(x,t)}{\partial t} = \frac{\partial U_i(x,t)}{\partial t}$$

$Q(x_i, t)$: the Lagrangian (Material) ^{مادري} description of any point
 $q(x_i, t)$: the Eulerian (spatial) ^{فضائي} description of a -

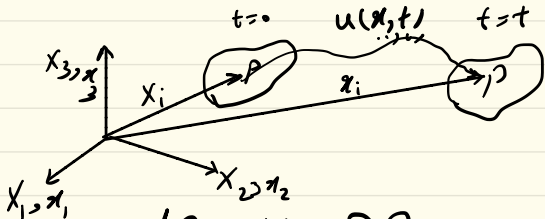
$$Q(x_i, t) = Q[x_i(x, t), t] = \mathcal{L}(x_i, t)$$

$$\mathcal{L}(x_i(x, t), t) = Q[x_i, t]$$

$$\begin{cases} x_i = x_i(x, t) \\ x_i = x_i(x, t) \end{cases}$$

$$\text{grad}(Q(x, t)) = \frac{\partial Q(x, t)}{\partial x}, \quad \text{grad}(\mathcal{L}(x, t)) = \frac{\partial \mathcal{L}(x, t)}{\partial t}$$

$$\begin{cases} x_1 = 5x_1 + 6x_2^3 + 3 \sin x_3 \\ x_2 = - - - - + \\ x_3 = - - - - + \end{cases}$$



$$u_i(x, t) = U_i[x_i(x, t), t]$$

$$v_i(x, t) = V_i[x_i(x, t), t]$$

$$\frac{dQ(x, t)}{dt} = \frac{\partial Q(x, t)}{\partial t} = \frac{\partial \mathcal{L}(x_i(x, t), t)}{\partial t} \quad (*)$$

$$\frac{\partial Q(x, t)}{\partial t} = \frac{\partial \mathcal{L}}{\partial x_i} \bigg|_{x_i = x_i(x, t)} \cdot \frac{\partial x_i(x, t)}{\partial t} + \frac{\partial \mathcal{L}}{\partial t} \bigg|_{x_i = x_i(x, t)}$$

$$\frac{\partial Q}{\partial t} = \frac{\partial Q}{\partial x_i} \bigg|_{x_i = x_i(x,t)} \cdot v_i(x,t) + \frac{\partial Q}{\partial t} \bigg|_{x_i = x_i(x,t)}$$

یہ طریقے سے بہ آسانی خواہم بیان ادلیوں راستے بائیں:

$$\frac{\partial Q}{\partial t} \bigg|_{x_i = x_i(x,t)} = \frac{\partial Q}{\partial x_i} \cdot v_i(x,t) \bigg|_{x_i = x_i(x,t)} + \frac{\partial Q}{\partial t} \quad (**)$$

$$(*) \Rightarrow \frac{\partial Q}{\partial t} \bigg|_{x_i = x_i(x,t)} = \frac{dQ}{dt} \bigg|_{x_i = x_i(x,t)} = \frac{dQ}{dt} \quad (**)$$

$(**)$
 $(**)$
 $(*)$

$$\frac{dQ(x,t)}{dt} = \frac{\partial Q}{\partial t} + v_i \frac{\partial Q}{\partial x_i}$$

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

Convective (or Eulerian)
 derivative

مشتق کلیدی فضائی
 (ادلیوں)

$$v_i(x, t) = \frac{du_i(x, t)}{dt} = \frac{\partial u_i(x, t)}{\partial t} + v_j \frac{\partial u_i}{\partial x_j}$$

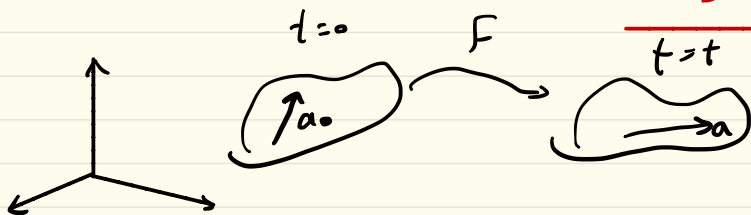
Holzzapfel

p. 69 $N: 1, 3$

p. 75 $N: 2$

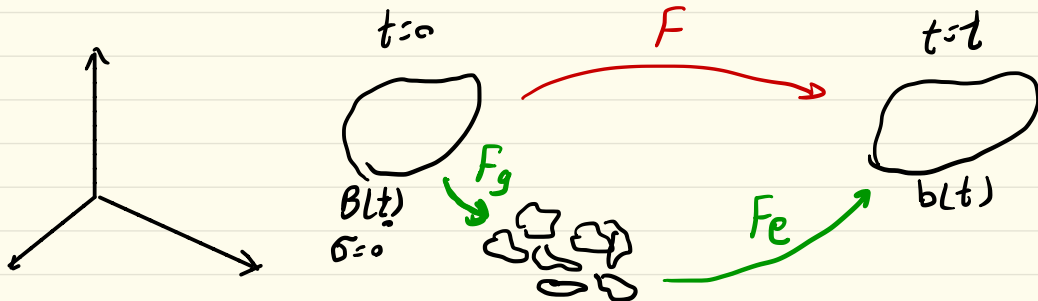
تمرین ۶

تا نور را دیدیم تغییر شکل (F) دریافت زنده:



$$\vec{\sigma} = F \vec{a}_0$$

$$|\vec{a}| = \lambda |\vec{a}_0|$$



$$F = F_e \cdot F_g$$

$$\begin{aligned} d\vec{x} &= F \cdot d\vec{x}' \\ d\vec{x} &= F_g \cdot d\vec{x} \\ d\vec{x} &= F_e \cdot d\vec{x}' \end{aligned}$$

$$\left. \begin{aligned} & \\ & \\ & \end{aligned} \right\} d\vec{x} = F_e \cdot F_g \cdot d\vec{x}'$$

F_g : growth deformation gradient tensor

از طریق آزمایش بیس می آید.

F_e : elastic deformation gradient tensor

سب ایجادکنش الاستیک همانند جسم می شود.

$$J = J_e J_g$$

