0주차 - X, X

2016 이산구조

gs1XXXX(XX기 XXX)

경기과학고등학교

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1.1

관성계 : 절대 좌표계 (x, y, z)

비관성계 : 회전좌표계 (x', y', z') 극좌표 (r, θ, z)

$(x, y, z) \to (r, \theta, z)$

수평 방향은 정역학 평형 상태에 있으므로, $(x, y) \to (r, \theta)$

$\vec{F} = F_x \hat{i} + F_y \hat{j}$

$F_x = m\frac{d^2x}{dt^2}$, $F_y = m\frac{d^2y}{dt^2}$

$(x, y) = (r\cos\theta, r\sin\theta)$

$$F_r = F_x \cos\theta + F_y \sin\theta = m\left(\frac{d^2x}{dt^2}\cos\theta + \frac{d^2y}{dt^2}\sin\theta\right)$$

$$F_\theta = F_y \cos\theta - F_x \cos\theta = m\left(\frac{d^2y}{dt^2}\cos\theta - \frac{d^2x}{dt^2}\cos\theta\right)$$

1.2

$x = r\cos\theta,\ \frac{dx}{dt} = \cos\theta\frac{dr}{dt} - r\sin\theta\frac{d\theta}{dt},$

$\frac{d^2x}{dt^2} = \cos\theta\frac{d^2r}{dt^2} - \sin\theta\frac{dr}{dt} - \sin\theta\frac{dr}{dt}\frac{d\theta}{dt} - r\cos\theta\frac{d^2\theta}{dt^2}$

$y = r\sin\theta,\ \frac{dy}{dt} = \sin\theta\frac{dr}{dt} + r\cos\theta\frac{d\theta}{dt},$

$\frac{d^2t}{dt^2} = \sin\theta\frac{d^2r}{dt^2} + \cos\theta\frac{dr}{dt} + \cos\theta\frac{dr}{dt}\frac{d\theta}{dt} - r\sin\theta\frac{d^2\theta}{dt^2}$

정리하면,

$F_r = m\left[\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2\right]$

$F_\theta = m\left[r\frac{d^2\theta}{dt^2} + 2\frac{dr}{dt}\frac{d\theta}{dt}\right]$

1.3

$\frac{d\theta}{dt} = \Omega,\ r\frac{d\theta}{dt} = r\Omega,\ u_\theta,\ \frac{dr}{dt} = v_r$

$\frac{d}{dt}r^2\Omega = 2r\frac{dr}{dt}\Omega + r^2\frac{d\Omega}{dt}$

$= \mathrm{r}\left(r\frac{d\Omega}{dt} + 2\frac{dr}{dt}\Omega\right)$

$y = r\sin\theta,\ \frac{dy}{dt} = \sin\theta\frac{dr}{dt} + r\cos\theta\frac{d\theta}{dt},$

$\frac{d^2t}{dt^2} = \sin\theta\frac{d^2r}{dt^2} + \cos\theta\frac{dr}{dt} + \cos\theta\frac{dr}{dt}\frac{d\theta}{dt} - r\sin\theta\frac{d^2\theta}{dt^2}$

정리하면,

$F_r = m\left[\frac{d^2r}{dt^2} - r\left(\frac{d\theta}{dt}\right)^2\right]$

$F_\theta = m\left[r\frac{d^2\theta}{dt^2} + 2\frac{dr}{dt}\frac{d\theta}{dt}\right]$

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asdf

Lorem Ipsum Dolor Sit Amet