Lecture Module - Newton's Approach

ME3050 - Dynamic Modeling and Controls

Mechanical Engineering

Tennessee Technological University

Topic 3 - The Velocity Model

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- Example Problem - Quadcoptor Model
- Mathematical Modeling
- Newton's Second Law Approach
- Derived Equations of Motion

Example Problem - Quadcoptor Model

Problem Statement -

Image: source needed

Mathematical Modeling

First, consider the physical problem and list all simplifying assumptions necessary or desired. In general, the designed should start simple and add complexity incrementally.

Quadcopter Model Assumptions:

1.
2.
3.

Newton's Second Law Approach

Newton's Second Law Approach

1.
2.
3.
4.
5.

Newton's Second Law Approach - Steps 1,2 and 3

Newton's Second Law Approach - Steps 4,5

Translation: $\Sigma \mathrm{F} = m\mathrm{a}$ $\quad \Sigma F_x = ma_x$

$\Sigma F_y = ma_y$

$\Sigma F_z = ma_z$

Rotation: $\Sigma \mathrm{M} = I_o\alpha$ $\quad \Sigma M_o = I_o\alpha_z$

Derived Equations of Motion