MAE223-L12-01

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- For a general dyadic pre and post multiplication by an arbitrary vector $\bar{v}$ give different results. However an inertia dyadic is symmetric and produces the same result in pre and post multiplication.
- There is only <u>one</u> inertia dyadic even though there are an infinite number of inertia matrices. The inertia matrix depends on the choice of RF.
- When O is the center of mass of S then call "Central inertia dyadic" $\bar{\bar{I}}^{S/o}$

There relationship between dyadics for different points. E.G. if point Q (arbitrary)

$$\underset{\substack{\uparrow \\ \text{arbitrary} \\ \text{point}}}{\bar{\bar{I}}^{S/Q}} = \underset{\substack{\uparrow \\ \text{mass} \\ \text{center} \\ \text{of } S}}{\bar{\bar{I}}^{S/S_o}} + \bar{\bar{I}}^{S_o/Q}$$

inertia of "particle at mass center of mass m_{TOT}"

S : collection of particles or RBs.

General form of the parallel axis theorem.

Principal Axes

In general the inertia vector is not parallel to $\hat{n}_a$. But sometimes it is and when it is then $\hat{n}_a$ and its line L are called a principal axis of S for O. The plane that is normal to $\hat{n}_a$ is called the principal plane. M.I is principal moment of inertia about $\hat{n}_a$, L. If $\hat{s}_i$ are principal directions if aligned with $\hat{n}_a$. You can write principal dyadic like:

$$\bar{\bar{I}}^{S/o} = I_1^{S/o}\hat{s}_1\hat{s}_1 + I_2^{S/o}\hat{s}_2\hat{s}_2 + I_3^{S/o}\hat{s}_3\hat{s}_3$$