Shifting the Inertia Tensor
(parallel axis theorem in 3D)

- Given an inertia tensor at the COM

$$I_{com}$$

- We can find the inertia tensor at a new point as follows:

$$I_r = I_{com} - mS(r)S(r)$$

- Where the vector r is the vector from the new point to the COM and S() is the skew matrix operator.

Rotating the Inertia Tensor

- We can rotate an inertia tensor into any frame, but for the Euler-Lagrange equations of motion, we have to rotate the inertia tensor into an inertial frame (the base frame) as follows:

$$I^0 = R_i^0 I^i R_i^{0^T}$$

Other

- Common rotational inertias for some shapes can be found at Wikipedia or – http://www.alpcentauri.info/moments_of_inertia_table.html
  - Ixx, Iyy, or Izz can be found independently using this table if the shape is symmetric and mass is equally distributed about the COM.
- Or look in a dynamics book which is probably better.