Mecánica Clásica
Tarea 05: Cuerpo Rígido II − Ecuaciones de Movimiento

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Nombre del Estudiante: _____

Problema 1 *Euler's equations*

Derive Euler's equation of motion:

$$I_3\dot\omega_3 - \omega_1\omega_2(I_1 - I_2) = N_3,$$

from the Lagrange equations,

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot q_j}\right) - \frac{\partial T}{\partial q_j} = Q_j \;\; \forall \;\; T = \text{kinetic energy},$$

for the generalized coordinate ψ, using the Euler's angles set $\{\phi, \theta, \psi\}$.

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Problema 2 *Right cylinder*

What is the height-to-diameter ratio of a right cylinder such that all principal moments of inertia at the center of the cylinder are the same?

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Problema 3 *Right triangle*

Calculate the principal moments of inertia and principal axes about the center of mass of a flat rigid body in the shape of 45° right triangle with uniform mass density.
*Hint*: the center of mass is located at the point where the medians intersect.

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Problema 4   *Plate*

A thin square plate with side lenght a rotates at a constant angular frequency ω about an axis through the center tilted by an angle θ with respect to the normal of the plate.

1. Find the principal moments of inertia.

2. Find the angular momentum **L** and the torque components along the principal axes of the plate.

3. Calculate the angular momentum **L** and the torque in the laboratory (fixed) system.

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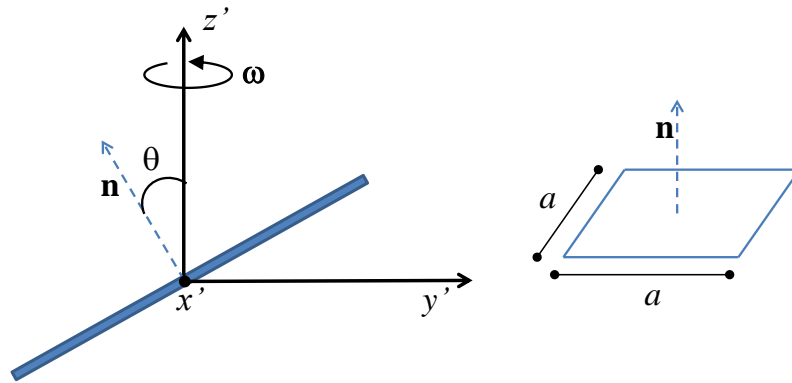
Problema 5   *Triangle oscillator*

Find the frequency of small oscillations for a thin homogeneous plate if the motion takes place in the plane of the plate and if the plate has the shape of an equilateral triangle and is suspended:

1. from the midpoint of one side.

2. from one vertex.

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