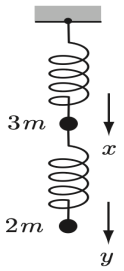
Mecánica Analítica

Tarea 9

Se entrega el Viernes 28 de Noviembre

1. A particle A of mass $3m$ is suspended from a fixed point O by a spring of strength α, and a second particle B of mass $2m$ is suspended from A by a second identical spring (see Figure). The system performs small oscillations in the vertical straight line through O. Find the normal frequencies, the forms of the normal modes, and a set of normal coordinates.



2. A uniform rod of length $2a$ is suspended from a fixed point O by a light inextensible string of length b attached to one of its ends. The system moves in a vertical plane through O. Take as coordinates the angles θ and ϕ between the string and the rod respectively and the downward vertical. Show that the equations governing small oscillations of the system about $\theta = \phi = 0$ are

$$b\ddot{\theta} + a\ddot{\phi} = -g\theta \quad , \tag{1}$$

and

$$b\ddot{\theta} + \frac{4}{2}a\ddot{\phi} = -g\phi \quad . \tag{2}$$

For the special case in which $b = 4a/5$, find the normal frequencies and the forms of the normal modes.

3. A mass particle moves in a constant vertical gravitational field along the curve defined by $y = ax^4$ where y is the vertical direction and a is constant. Find the equation of motion for small oscillations about the position of equilibrium.