

- (20%) During the airborne execution of a spike in volleyball, what principle in mechanics can be used to explain the movements of the hitting arm and the legs shown in Figure 1? (Hint: The spiking arm and the legs rotate in opposite direction.) We know that the angular velocity of the legs is much less than the angular velocity of the spiking arm. Why?
- (20%) The system shown in Figure 2 is used to transport people from a level defined by $\theta = 0$ to other levels for the range $(0 \leq \theta \leq \pi)$. Assume that $\theta = 0.5t^{3/2}$ where θ is in radians and t is in seconds. Develop expressions, in terms of L and t , for the velocity and acceleration of the passengers. If the acceleration of the passengers is to be 6 m/s^2 when $\theta = \pi/2$, what should be the dimension L ? What is the velocity for this position?
- (20%) During level walking, the foot position and foot-ground contact force are measured and known at each instant. What other parameters are necessary to be known in order to compute the resultant force and resultant moment of the ankle joint? List the required formulas.
- (20%) Slip and fall often occur in the elderly. Considering the body segments' movement or response during slipping, what mechanical principles can be used for the study and analysis of the slipping activity? Why does the slipping occur? How is body segments' response? Why?
- (20%) The animation and simulation of human movements have been widely used in computer games and movies. In the fighting game of both fighters, you should enjoy the vivid, dynamic feeling and fun. If the posture and movements of the fighters are generated from the realistic the human movements measured by motion capture machines, what measured parameters should be used in computer animation of human movement to represent each segment orientation and position from the viewpoint of mechanics?

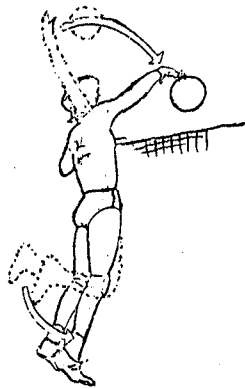


Figure 1

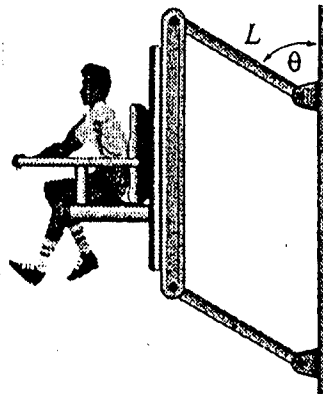


Figure 2