Answer on Question #53268, Physics / Mechanics | Kinematics | Dynamics

A rigid body exists in n dimensional space, how many coordinates are needed to specify the position and orientation in this space?

Solution:

The position and orientation of a rigid body in three-dimensional space is defined by three components of translation and three components of rotation, which means that it has six degrees of freedom.

If a body is rigid, then its position can be uniquely specified by a number of generalized coordinates equal to the number of degrees of freedom.

The position of an rigid body in n-dimensional space is defined by the rigid transformation,

$$[T] = [A, d],$$

where d is an n-dimensional translation and A is an n × n rotation matrix, which has n translational degrees of freedom and n(n − 1)/2 rotational degrees of freedom. The number of rotational degrees of freedom comes from the dimension of the rotation group SO(n).

Answer: $n+ n(n - 1)/2$