Spectral Rigid Body Dynamics

Mikola Lysenko

May 3, 2010

Overview

Rigid Body Dynamics

Limiting case of continuum dynamics where elastic modulus is infinite.

Pros:

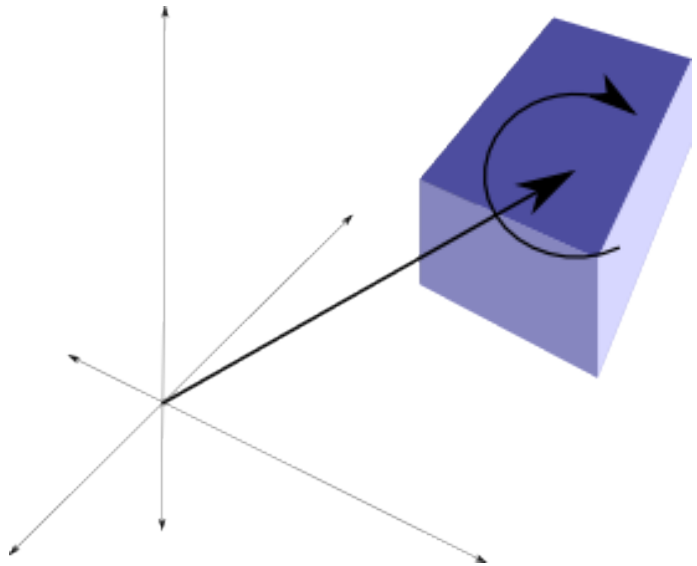
- Pretty accurate at human scales
- Good for materials which are stiff
- Efficient kinematic constraints (good for mechanism design)

Cons:

- Inaccurate at extremely small or large scales
- Bad for materials with low elastic modulus
- Not always solvable (See: Painleve's paradox)

Configuration Space of a Rigid Body

Must be a Euclidean isometry



Identified with translation + rotation, (ie $SE(d) \cong SO(d) \ltimes \mathbb{R}^d$)
Tangent space is isomorphic to $\mathfrak{so}(d+1)$

Phase Flow in $SE(d)$

Lagrangian Mechanics

Rephrases the evolution of a physical system in terms of an optimization problem.

$$\mathcal{L}(q, \dot{q}, t) = T(\dot{q}) - U(q, t)$$

Where