Uncertainty in Centre of Mass and Transformation Frames Applied to Physically-Based Character Animation Systems

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June 7, 2016

Abstract

We present a

1 Related Work

1.1 Physically-Based Animation Systems

Traditional character animation systems used in film & games rely artist-driven keyframing techniques. While proven to be effective, keyframing is known to be time-consuming and highly dependent on the skill of the artist.

1.2 Human Sensory Awareness

Significant study has been done in the field of neuroscience on the brain's representation of the human body. This topic has been coined various names self-attribution [1], the brain-body model [], and ... . However, there has not been a call to quantify this work into representations that can recreate convincing human motor error; integration into physically-based character animation systems may be a unique use-case in this instance.

2 A Model of COM Estimation

We use a function $g : \mathbb{R}^3 \to \mathbb{R}$ to model the relative certainty that the centre of mass, C_M lies at point $p \in \mathbb{R}^3$. The function itself is composed of the following components.

$$g = \alpha g_0 + V + \sum J_R + J_V \tag{1}$$

Where g_0 is the distribution of the previous frame, V is the velocity of the previous frame, α is a damping constraint, J_R is the change from joint rotations, and J_V is the change from joint torques.

We then consider a stochastic walk of distance d from the last estimate of C_M weighted along the gradient of the function g. d is given precisely as the change in the function g monte-carlo sampled about the point C_M.

$$d = \iiint_M (g_0 - g) dV \tag{2}$$

3

TODO

1. Better random sampling function. (more random sins?)
2. g function setup.
3. Volume integral setup.

References

[1] Stelian Coros, Philippe Beaudoin, and Michiel van de Panne. Generalized biped walking control. *ACM Transctions on Graphics*, 29(4):Article 130, 2010.