Flamenco

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Introduction

Matthias Müller et al introduced Position-Based Dynamics (PBD) in 2004 as a generalizable framework for simulating physically plausible particle-based dynamics. This method has been proven to be fast, even on the CPU, and easily generalizable to other physically-based phenomena; so much so that it is becoming the gold standard method in games. At GDC 2018, the EA Frostbite team revealed their particular implementation of a PBD cloth sim that caches self-collisions to save time on an otherwise O(N^2) loop. On the CPU, the team reports 20 fps performance. We propose to recreate their CPU-based algorithm, then extend it to compute shaders on the GPU, thereby achieving real-time performance with physically plausible self-interacting cloth.

Goals

PBD cloth solver on the GPU using D3D12 compute shaders, including a parallelized constraint solver on a pre-computed mesh graph and cached self-interactions.

Milestones

11/19	Basic CPU Implementation of PBD Cloth
11/26	GPU Compute Implementation (color grid method)
12/03	CPU self-collision caching
12/07	GPU self-collision caching + Renders + Performance Analysis
12/10	Documentation

References

- Cloth Self-Collision with Predictive Contacts
  [Reference]
- A GPU-Based Implementation of Position Based Dynamics for Interactive Deformable Bodies
  [Reference]
- Position-Based Simulation Methods in Computer Graphics
  [Reference]