

Project Flamenco

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Objective

Implement a Position-Based Dynamics (PBD) cloth simulation algorithm on the GPU using predictive constraints – a technique introduced at GDC 2018 by EA's Frostbite team.

Currently, this runs on the Frostbite Engine but no game has shipped with this tech so far. Anthem may be the first.

Project Milestones

- 11.19
 - (CPU) core PBD algorithm
 - Cloth mesh discretization
 - Distance + bending constraints
- 11.26
 - (GPU) core PBD algorithm
 - Jacobi-style constraint solver using D3D12 compute shaders
 - Environment collision constraints
- 12.03
 - Self-collision constraints using predictive contacts
 - Acceleration structure using AABB
 - Rendering pipeline
- 12.07
 - FINAL PRESENTATION

(GPU) Core PBD Algorithm



30 x 30 at ~560 fps

$$k_{\text{distance}} = 0.3$$

$$k_{\text{bending}} = 0.3$$



30 x 30 at ~560 fps

$$k_{\text{distance}} = 0.8$$

$$k_{\text{bending}} = 0.8$$



100 x 100 at ~330 fps

$$k_{\text{distance}} = 0.99$$

$$k_{\text{bending}} = 0.7$$



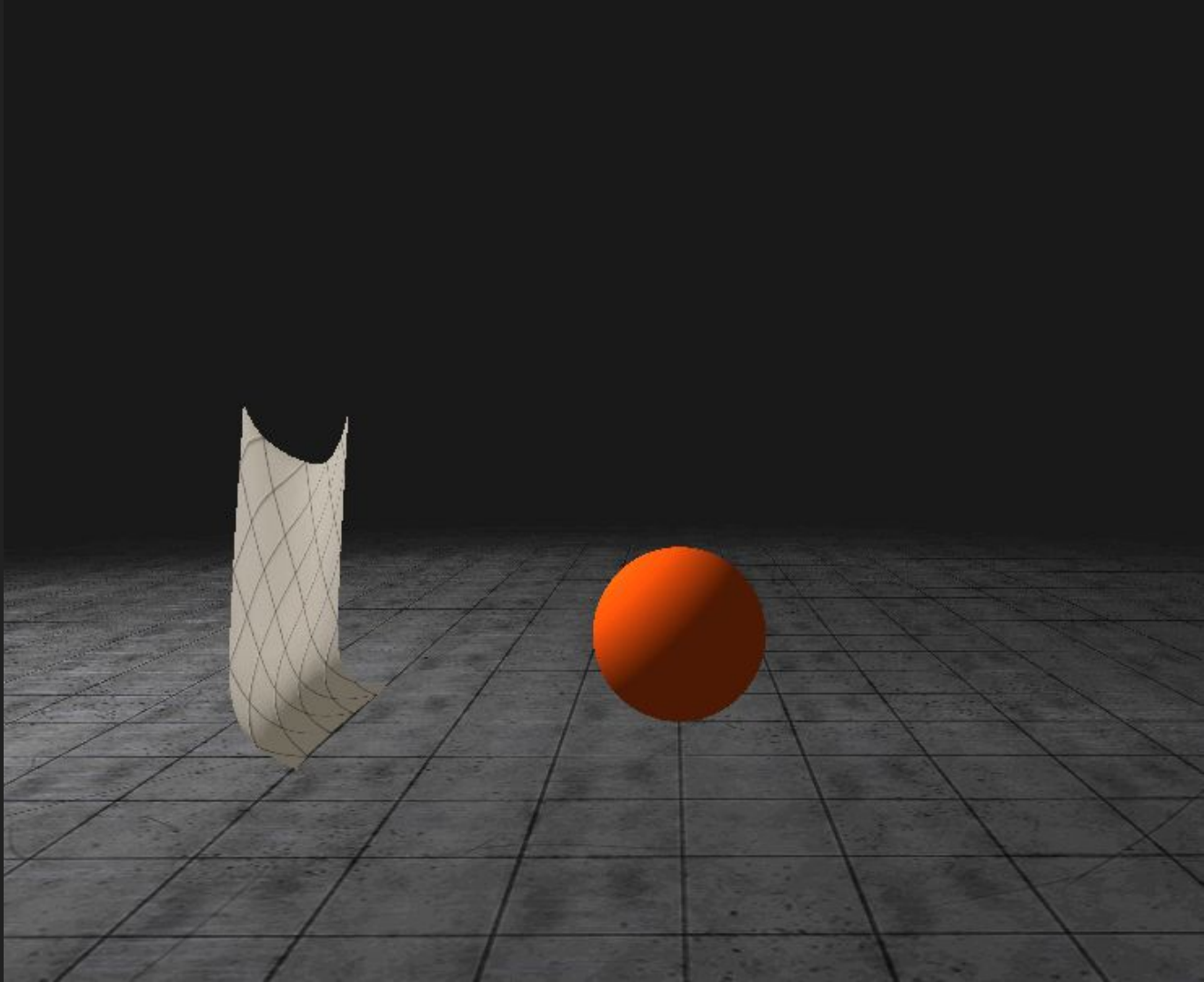
300 x 300 at ~330 fps

$$k_{\text{distance}} = 0.99$$

$$k_{\text{bending}} = 0.7$$

Environment Collision Constraints

- SDF Based Collisions
 - Sphere Collisions
 - Plane Collisions
- Executed in Compute Shader



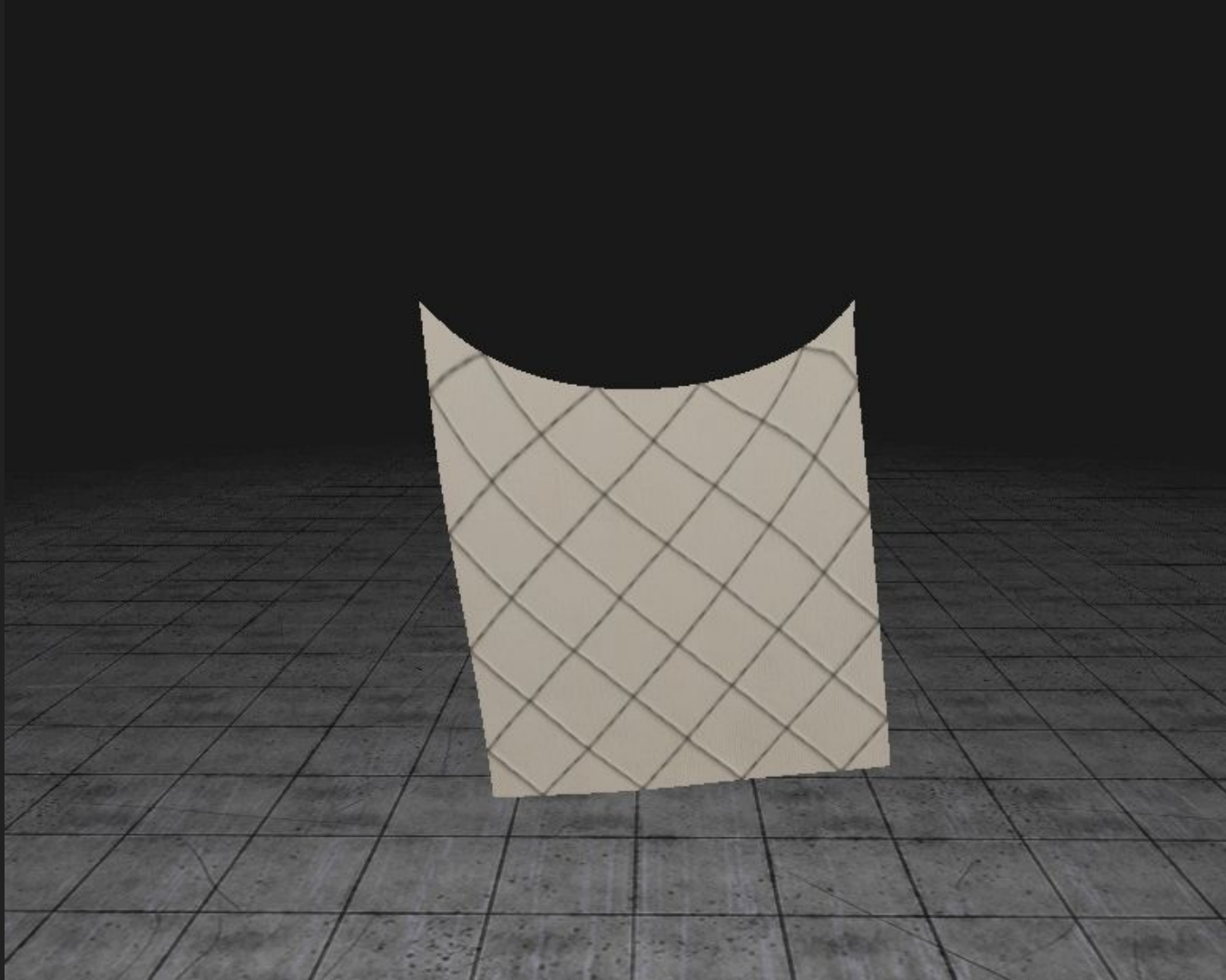
Rendering Pipeline

- Diffuse Textures
- Normal Maps
- Roughness Maps
- AO Maps

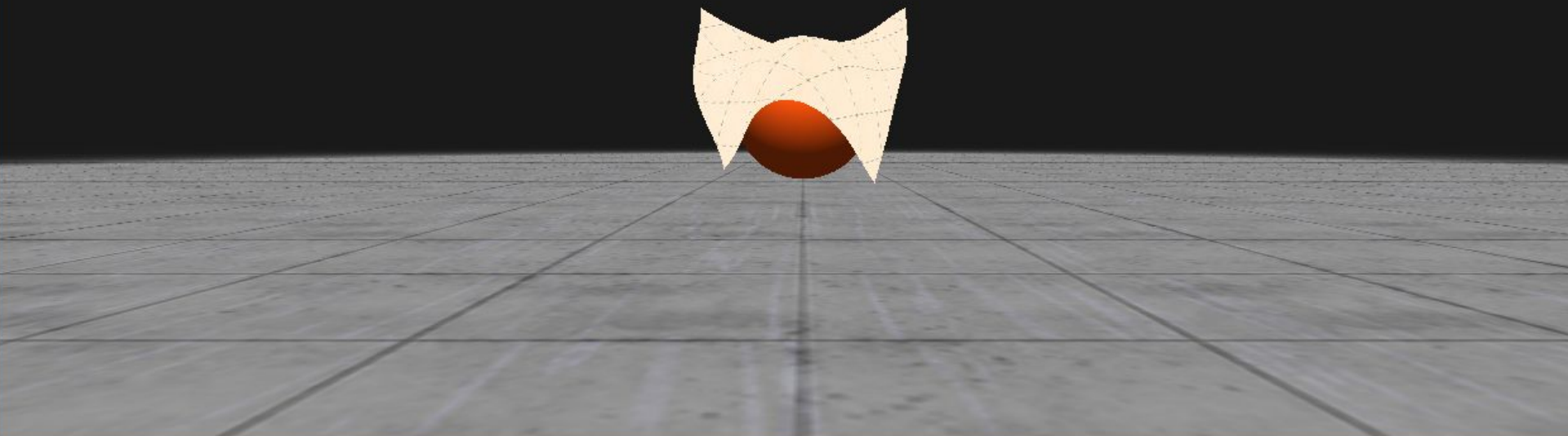
- Tone mapping
- Exposure & Gamma Correction

Key points:

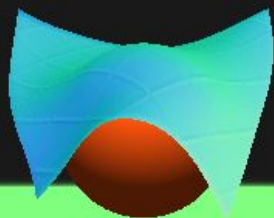
- No TLS (Shared Memory)
- 512 Threads / Block



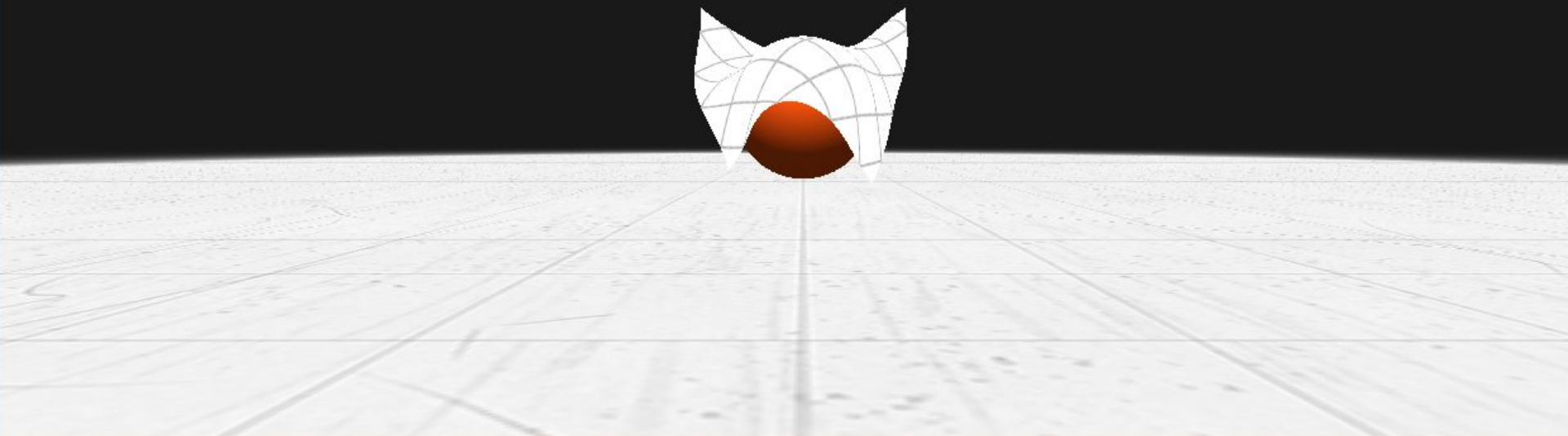
Frame Breakdown



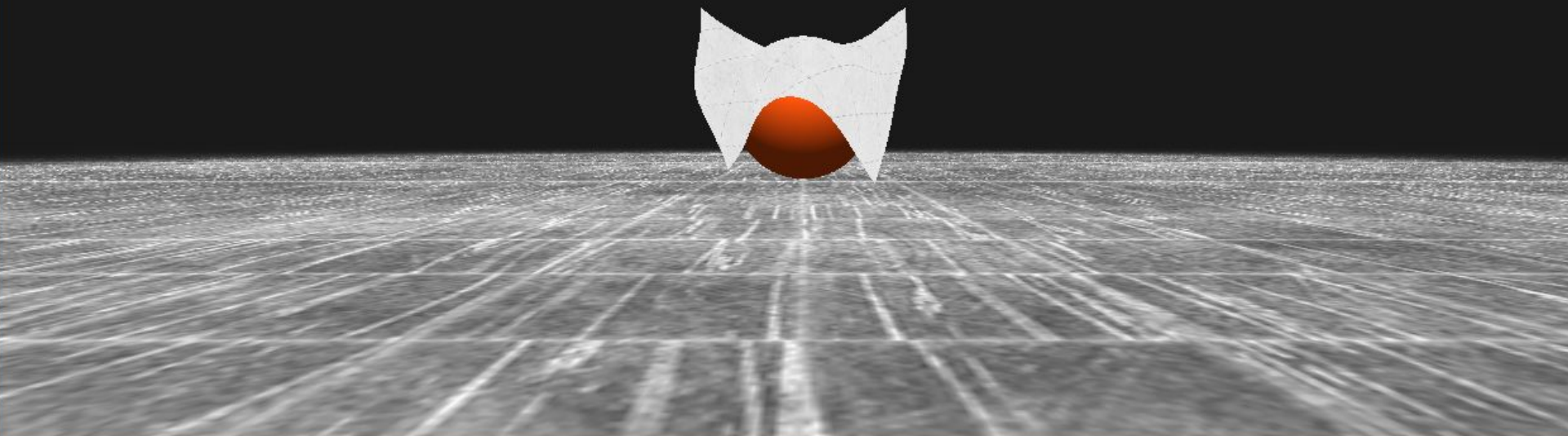
Frame Breakdown



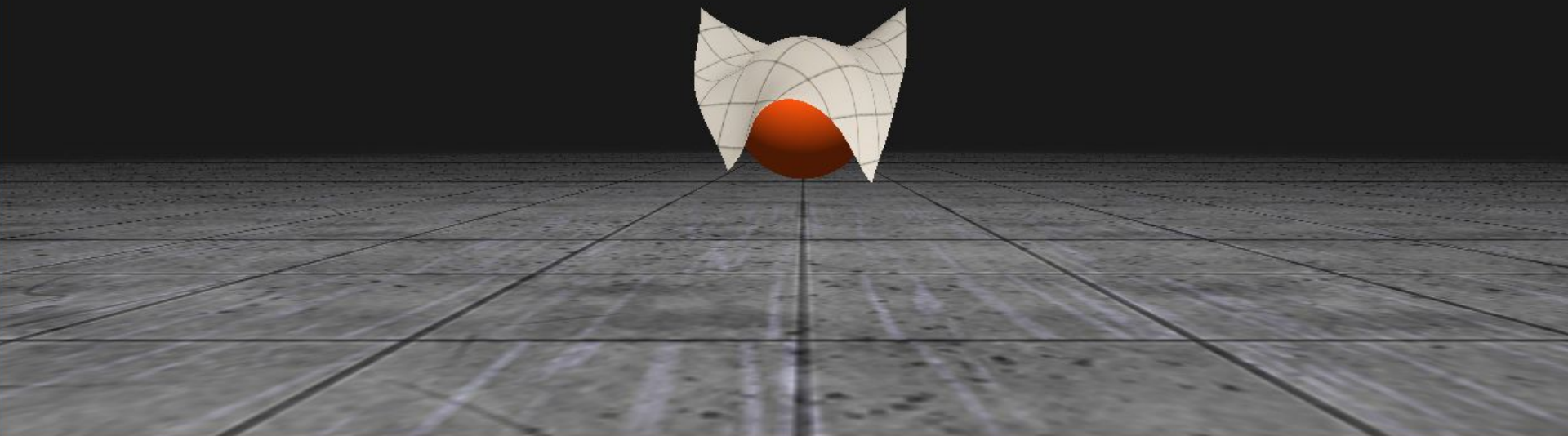
Frame Breakdown



Frame Breakdown



Frame Breakdown



Project Roadmap

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