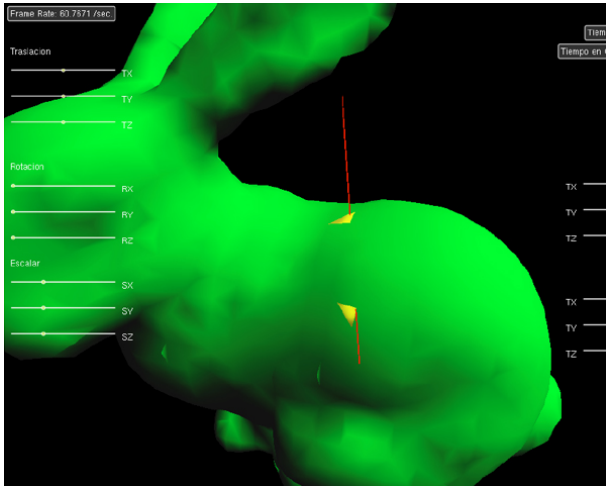


# Parallel GPU Collision Computation in Conformal Warped Space For Surface Detail Haptic

Theoktisto, Victor; Fairen, Marta; Navazo, Isabel



Introducing a parallel collision computation procedure in GPU for rendering accurate touch sensation in highly complex geometric models. An objects geometry is covered completely by a connected mesh of edge-joined prismoids, while surface detail is encoded by an image-based approach in a special tangent space flat texture containing relief and surface normals values. Heights and normals within each prism are warped from object volume space to orthogonal tangent space, by means fast method for computing barycen-tric coordinates, and stored in a per-face sorted RGBA texture. Parallel computation is performed in GPU

for many prisms at once. Applying a unified treatment of col lision detection in conformal space from euclidean 3 (3D) to a higher dimensional conformal space 4,1 (5D), CUDA core kernels perform parallel real-time collision detection in GPU, with a haptic probes position vector without any bounding volume prefiltering, to identify which prisms of the objects surface are being touched, and then map coordinates to tangent space, sampling relative surface height and normal from texture, for a final decision on whether the surface was hit. Results show throughput is increased between one and two orders of magnitude in collision benchmarks among known mesh models, computed in blind all vs. all manner, accurately colliding against 3D surface detail at high sampling rates without degrading touch sensation.