AN IMPROVED TIME-CRITICAL COLLISION CULLING SCHEME FOR MULTI-RIGID BODY AND HUMANOID MODEL

NAME: NORHAIDA MOHD SUAIB

SUPERVISOR: PROF. DR. DZULKIFLI MOHAMAD
CO-SUPERVISOR: ASSOC. PROF. DR. ABDULLAH BADE

Maintaining interactive frame rates while providing physically plausible experience is of major importance in interactive virtual environment applications where collision detection is an importnt part of the system. However, due to its computationally intensive nature, collision detection can become a bottleneck of the system. Objects interaction cannot be anticipated most of the time but constant frame rates need to be maintained. This research addressed the issue of low and unstable frame rates due to inconsistent number of collisions involved in every simulation frame for multi-rigid body and humanoid model. The idea is to improve collision culling process and adapt it to time-critical approach where accuracy of collision tests can be negotiated for speed. An adjustable time-critical collision culling scheme was achieved through collision culling levels-of-details (LOD) and time-budgeted measurement. In short, the foundation of this collision culling scheme deals with improvement of collision culling technique named as Sphere-encapsulated Oriented Discrete Orientation Polytope (S-Dop) collision culling in order to reduce the all-pair weakness problem. There are choices in implementing this collision culling technique; sequentially, in batches and on object-of-interest; eacg offers its own strengh and uniqueness. Most importantly, this is the principal property that makes S-Dop readily adaptable to time-critical collision culling via different LOD. Time budgeted measurement used was based on frames-per-second (FPS) value that will be matched to suitable collision culling levels-of-details. Experiments involving multiple rigid body simulation with the range of 50 to 500 3D objects were conducted to testify the effects of the proposed scheme. The proposed scheme were later adapted to humanoid model and its surrounding 3D objects. This adjustable time-critical collision culling scheme ensures that high frame rates could be maintained – of at least 60 FPS, and in worst case to preserve a relatively stable frame rates as supported from the results from the experiments.