Collision Detection and Distance Computation
Chairs: Stephen Cameron, Ming Lin

Computing Signed Distances between Free-Form Objects

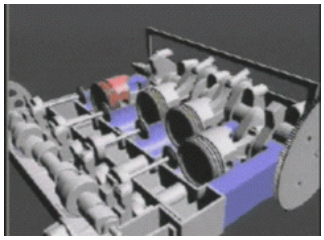
F. Thomas[1], C. Turnbull[2], L. Ros[1] and S. Cameron[2]
[1]Oxford University and [2]CSIC-UPC, Barcelona

- NURBS used to represent free-form surfaces
- Descent technique to track the minimum distance
- Bounds on patch applicability from control points
- Sub-division used to focus in on solution

Fast Distance Queries with Rectangular Swept Sphere Volumes

E. Larsen, S. Gottschalk, M. Lin and D. Manocha
University of North Carolina, Chapel Hill

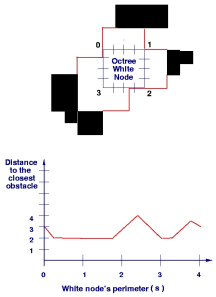
- Distance computation is essential in robot motion planning, dynamic simulation, virtual prototyping, simulation-based design and haptic rendering.
- Use of efficient bounding volume hierarchy of rectangle swept spheres, traversal coherence, and priority directed search
- Achieve upto an order of magnitude speedup over the state of art on many benchmarks from motion planning, dynamic simulation and virtual prototyping applications
- Plan to explore the possibility of hybrid hierarchy for general proximity queries



EODM- A Novel Representation for Collision Detection

M. Benitez, K. Gupta and B. Bhattacharya
Simon Fraser University

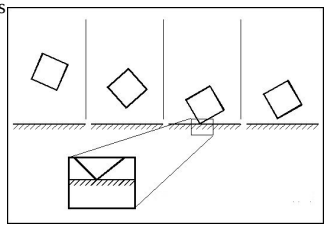
- Discretized Distance Maps speed-up collision detection, however, their memory requirements may be excessive. Octrees are memory efficient but slow for collision detection.
- The Extended Octree Distance Map (EODM) is a novel representation for efficient collision detection in static environments. It captures the distance to the obstacles in a hierarchical manner using octrees.
- EODM requires only a simple constant-time test, essentially a look up in the stored distance. EODM is computed once and repeatedly used for collision detection queries.
- Our preliminary experiments in 2D show that EODM speeds up collision detection by a factor of three to six compared to an octree.



An Algebraic Solution to the Problem of Collision Detection for Rigid Polyhedral Objects

S. Redon[1], A. Kheddar[2] and S. Coquillart[1]
[1]INRIA - Rocquencoart and [2]University d'Evry, France

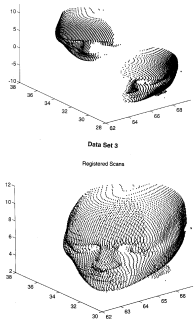
- Realistic and intuitive object manipulation in Virtual Environments
- Continuous collision detection using an arbitrary screwing-derived in-between motion
- The manipulation can be done at interactive rates
- Valuable approach for Collision Detection systems in Virtual Environments



Registration of Range Data Using a Hybrid Simulated Annealing and Iterative Closest Point Algorithm

J. Luck[1], C. Little[2] and W. Hoff[1]
[1]Colorado School of Mines and [2]Sandia National Laboratory

- Robust and efficient registration of range data
- A hybrid algorithm combining ICP and Simulated Annealing
- The algorithm is superior to either individual technique
- The algorithm is both robust and efficient.



Neural-Network Based Target Differentiation Using Sonar for Robotics Applications

Billur Barshan[1], Birsel Ayrulu[1] and Simukai W. Utete[2]
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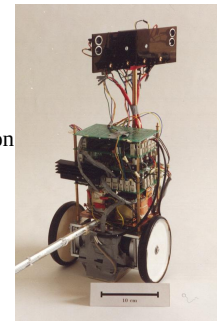
- Motivation and Problem Statement
- Neural-Network Based Target Differentiation
- Experimental Results
- Conclusions