



A FAST ALGORITHM IN COLLISION DETECTION AND MOTION ANALYSIS OF 3D POLYHEDRAL PARTS AND ITS APPLICATION IN INDUSTRY

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ABSTRACT—Animation is an efficient tool for visible presentation. On one hand, it has been widely applied into entertainment fields. In these fields, animation does not need precise physical dynamic model. On the other hand, animation can provide precise collision detection, which can be very useful in engineering, and particularly in virtual reality, computer aided design and human computer interface.

3-dimensional (3D) animation can be very useful and important to general engineering. For example, it can be used to test the validity of a new strategy and visibly present test result. However, 3D animation has not been widely used in general engineering so far. The major reasons are a) the collision detection process is slow and b) there is lack of research on how to fast calculate the location of contact points between objects and the real motion of a moving object in given environment.

Hinted from others' work, this paper proposed an algorithm, which has the following features:

- (a) fast detecting collision in 3D between a pair of moving convex objects with six-degrees of freedom. The computation cost is linear to the total number of vertices of two polyhedrons and,
- (b) more importantly, fast analysing contact features between polyhedral parts and calculating 3D motion, including compliant motion.

Furthermore, the validity of the algorithm has been proven in robotics field by building precise 3D assembly polytope. For any given sequence of robotic inputs, this polytope can detect the collision between the peg and the hole and calculate peg movement in 6 degrees of freedom with constraints of the hole.

Key Words: Real time 3D Animation, Robotics, Robotic Assembly