Povzetek

To delo predstavi izrek o ločni osi ter teoretično različico algoritma Gilbert–Johnson–Keerthi (GJK) ter njuno uporabo v zaznavi trkov med (konveksnimi) politopi v evklidskem prostoru $\mathbb{R}^3$. V prvem delu spoznamo teoretično ozadje afinih prostorov, konveksnih množic, politopov in konveksnih poliedrov, ki nam služi za izpeljavo izreka o ločni osi in GJK-ja ter razumevanje metod, s katerimi se kasneje srečamo. Na koncu so predstavljena še omejujoča območja in prostorske strukture za zmanjšanje časovne zahtevnosti zaznave trkov in števila potencialno prekrivajočih se parov teles.

Abstract

This work presents separating axis theorem (SAT) and the theoretical version of Gilbert–Johnson–Keerthi (GJK) algoritm and their application in collision detection between (convex) polytopes in Euclidean $\mathbb{R}^3$ space. The first part contains the theoretical fundations from affine spaces, convex sets, polytopes and convex polyhedra required to derive SAT and GJK and for understanding the methods we see later in this work. Finally, bounding volumes and spatial data structures are presented that reduce the time complexity of collision detection and the number of potentially intersecting pairs of objects.

Literatura

[1] Branko Grünbaum, *Convex Polytopes*. Springer-Verlag, New York, 2003.

[2] Gino van den Bergen, *Collision Detection in Interactive 3D Environments*. Elsevier, San Francisco, 2004.

[3] Elmer G. Gilbert, Daniel W. Johnson, S. Sathiya Keerthi, *A Fast Procedure for Computing the Distance Between Complex Objects in Three-Dimensional Space*. IEEE Journal of Robotics and Automation, vol. 4, no. 2, april 1988.

[4] David Eberly, *Intersection of Convex Objects: The Method of Separating Axes*. Magic Software, `http://www.geometrictools.com/`, 2002.

[5] David Eberly, *Dynamic Collision Detection using Oriented Bounding Boxes*. Magic Software, `http://www.geometrictools.com/`, 2003.

[6] Anatoli Juditsky, *Lecture 1: Convex Sets*.
`http://ljk.imag.fr/membres/Anatoli.Iouditski/cours/convex/chapitre_1.pdf`.

[7] Mathematics Stack Exchange.
`http://math.stackexchange.com/questions/80974/`.