# Gilbert-Johnson-Keerthi (GJK) Algorhytmus

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# Goal

Detection of collisions between convex bodies (fast)

With Extensions: calculate distances between objects

Application: Physics engines in games, Robotics, CAD systems

# Basic Principle

**Minkowski difference**

Two bodies collide if the origin (0,0,0) lies in this set.

**Support-Function**

For direction 𝑑:

returns the outermost point of the difference in direction 𝑑.

# Algorithm sequence

1. Select start direction (e.g., to the right).
2. Calculate support point and include it in the simplex.
3. Determine new direction (to the origin).
4. Add further support points → Simplex is constructed:
   1. 1 point → Change direction
   2. 2 points → Check edge
   3. 3 points → Check triangle (2D)
   4. 4 points → Check tetrahedron (3D)
5. Termination criteria:
   1. Origin in simplex → collision
   2. No further improvement → no collision

# Properties

Advantages:

* Very efficient, even for real-time physics.
* Any dimensions possible.
* Only support function required → no complete Minkowski object.

⚠️ Limitations:

* Only works for convex bodies.
* For non-convex objects → decomposition into convex parts.
* Only returns yes/no. Extensions are required for exact distance (e.g., EPA – Expanding Polytope Algorithm).

# Visualization (2D)

# Sources