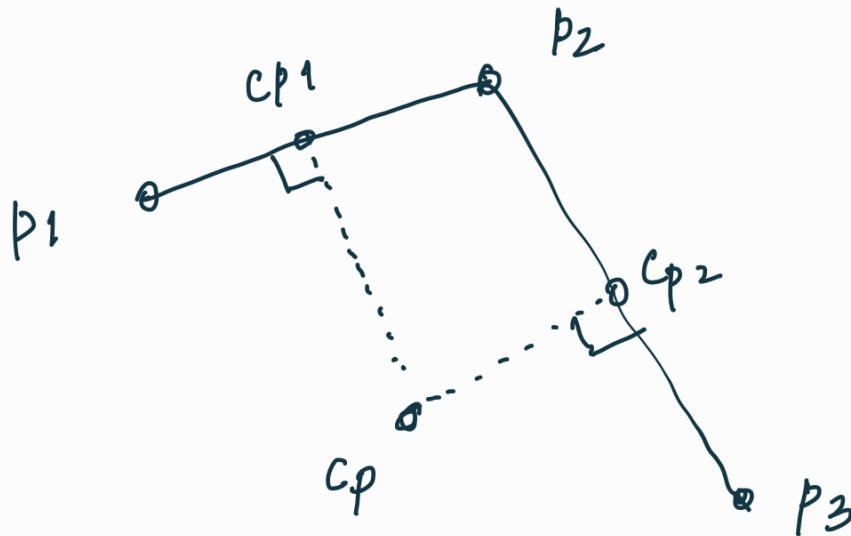


Calculating center from 3 points in Openscad



Steps

1. Check whether 3 points are arranged in CW or CCW orientation
clockwise or counter clockwise

$$V_1 = p_2 - p_1$$

$$V_2 = p_3 - p_1$$

Calculate cross product

$$n = \text{cross}(V_1, V_2)$$

$$CW = n < 0 ? 1 : -1 \quad (\text{where } 1 \text{ stands for CW} \\ \& -1 \text{ for CCW})$$

2. - Calculate center point between p_1 & p_2

$$cp_1 = (p_1 + p_2) / 2$$

3. - Calculate center point between p_2 & p_3

$$cp_2 = (p_2 + p_3) / 2$$

4 - find the perpendicular unit vector from line $p_1 p_2$

$$v_1 = p_2 - p_1$$

if the 3 points are CW

$$u_1 = \frac{v_1}{\text{norm}(v_1)} \times [[0, -1], [1, 0]] \leftarrow \begin{matrix} \text{for rotation} \\ \text{CW} \end{matrix}$$

otherwise if 3 points are CCW

$$u_1 = v_1 / \text{norm}(v_1) \times [[0, 1], [-1, 0]] \leftarrow \begin{matrix} \text{CCW} \\ \text{rotation} \end{matrix}$$

5 - Find perpendicular unit vector from line $p_2 p_3$

$$v_2 = p_3 - p_2$$

if the 3 points are CW

$$u_2 = v_2 / \text{norm}(v_2) \times [[0, -1], [1, 0]]$$

otherwise if the 3 points are ccw

$$u_2 = v_2 / \text{norm}(v_2). \quad [[0, 1], [-1, 0]]$$

6. Find the intersection between u_1 & u_2 .

$$cp_1 + u_1 \cdot t_1 = cp_2 + u_2 \cdot t_2 \quad \text{— where } t_1 \text{ \& } t_2 \text{ are unknown}$$

$$u_1 t_1 - u_2 t_2 = cp_2 - cp_1$$

from above 2 equations can be derived

$$u_1 \cdot x \cdot t_1 - u_2 \cdot x \cdot t_2 = (cp_2 - cp_1) \cdot x \quad \text{— (1)}$$

$$u_1 \cdot y \cdot t_1 - u_2 \cdot y \cdot t_2 = (cp_2 - cp_1) \cdot y \quad \text{— (2)}$$

The above 2 equations can be solved to get t_1 and t_2 with matrix equation or simple arithmetic

7. Therefore final step to get center point.

$$cp = cp_1 + u_1 \cdot t_1$$