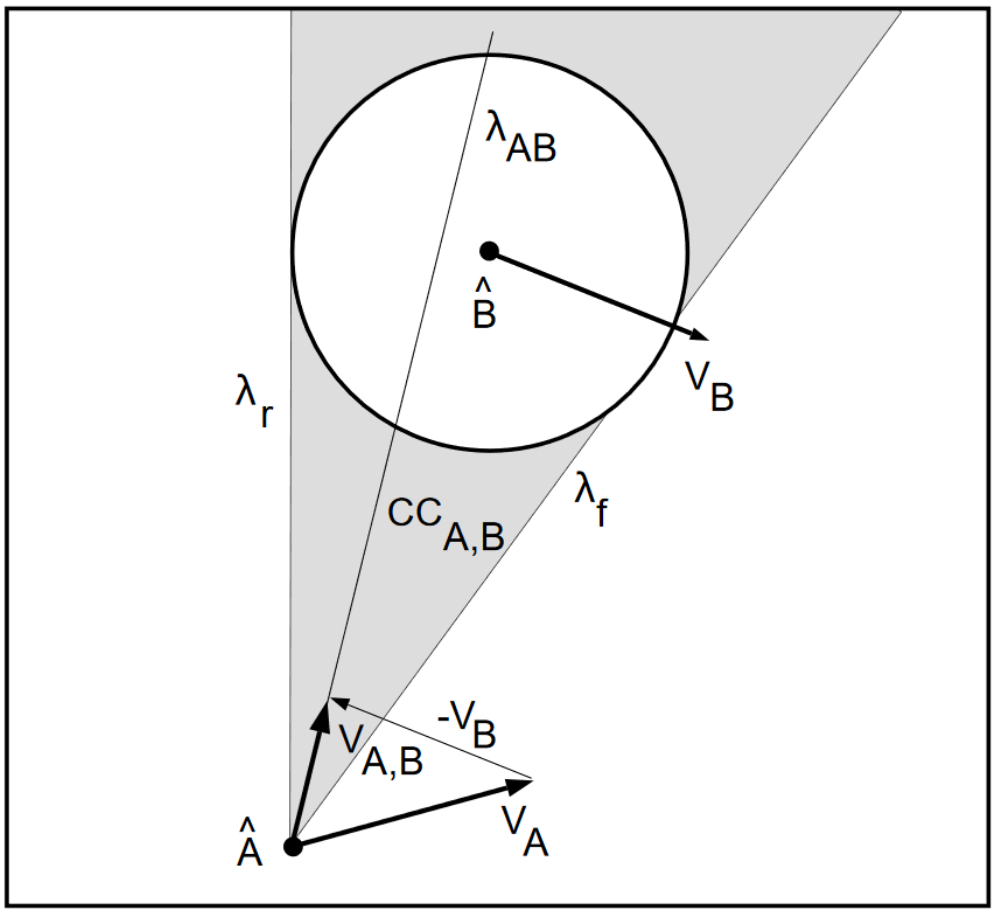
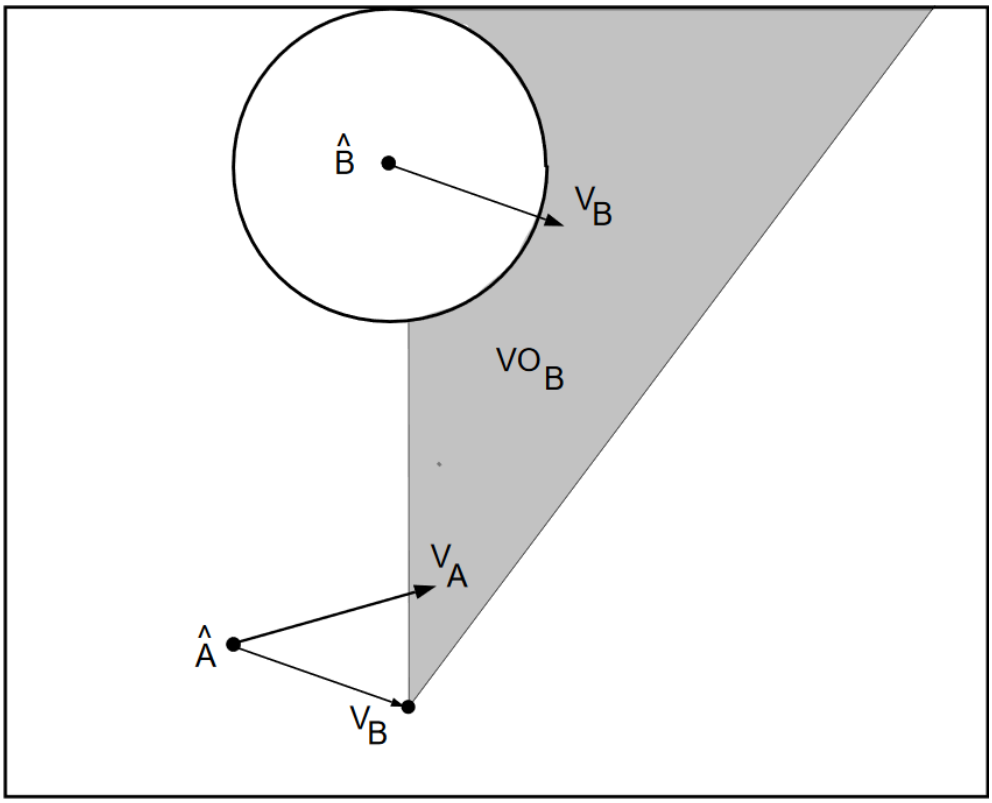
vo避障总结

- http://gamma.web.unc.edu/research/robotics/ VO算法在内，还有其他移动机器人算法
  - VO [1] P. Fiorini and Z. Shiller, “Motion planning in dynamic environments using velocity obstacles,” Int. J. Robot. Res., vol. 17, no. 7, pp. 760–772, Jul. 1998.
  - RVO http://gamma.cs.unc.edu/RVO/
  - HRVO http://gamma.cs.unc.edu/HRVO/
- VO
  - VO

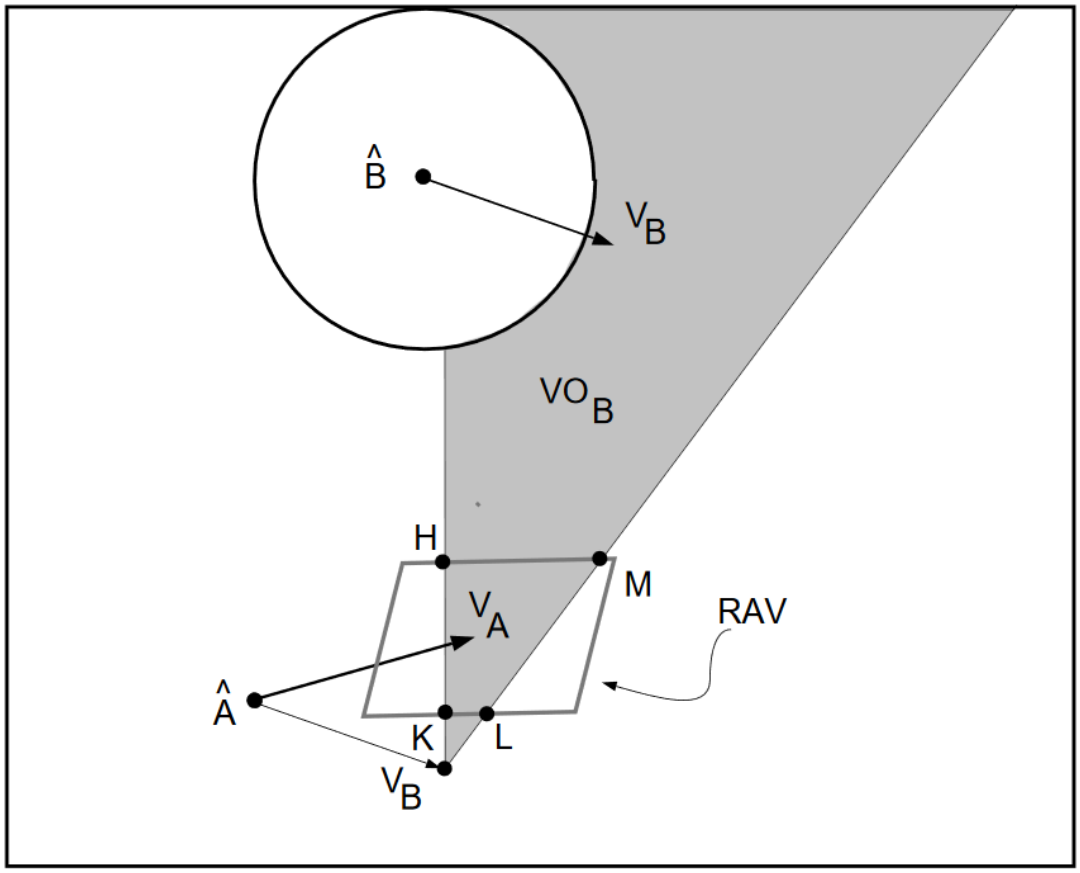




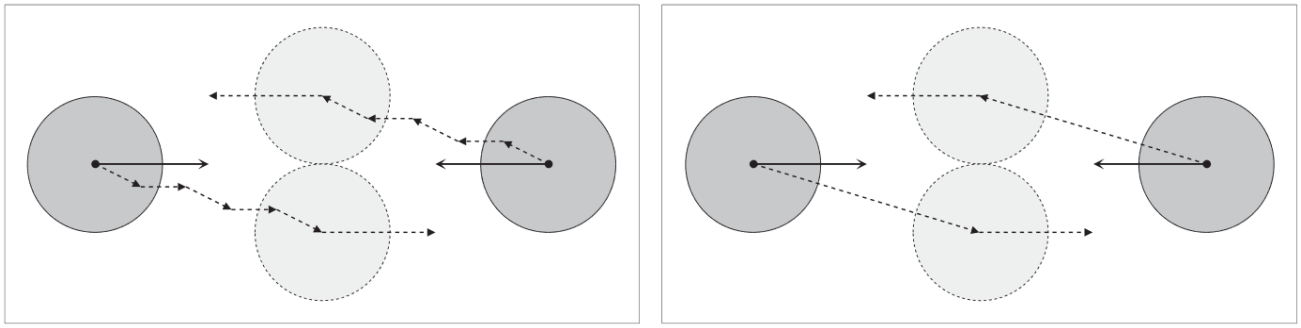
Definition 1 (Velocity Obstacle).

$$VO_B^A(\mathbf{v}_B) = \{\mathbf{v}_A \,|\, \lambda(\mathbf{p}_A, \mathbf{v}_A - \mathbf{v}_B) \cap B \oplus -A \neq \emptyset\}.$$

- RAV 可选取的速度



- RVO
  - 解决震荡问题



- RVO

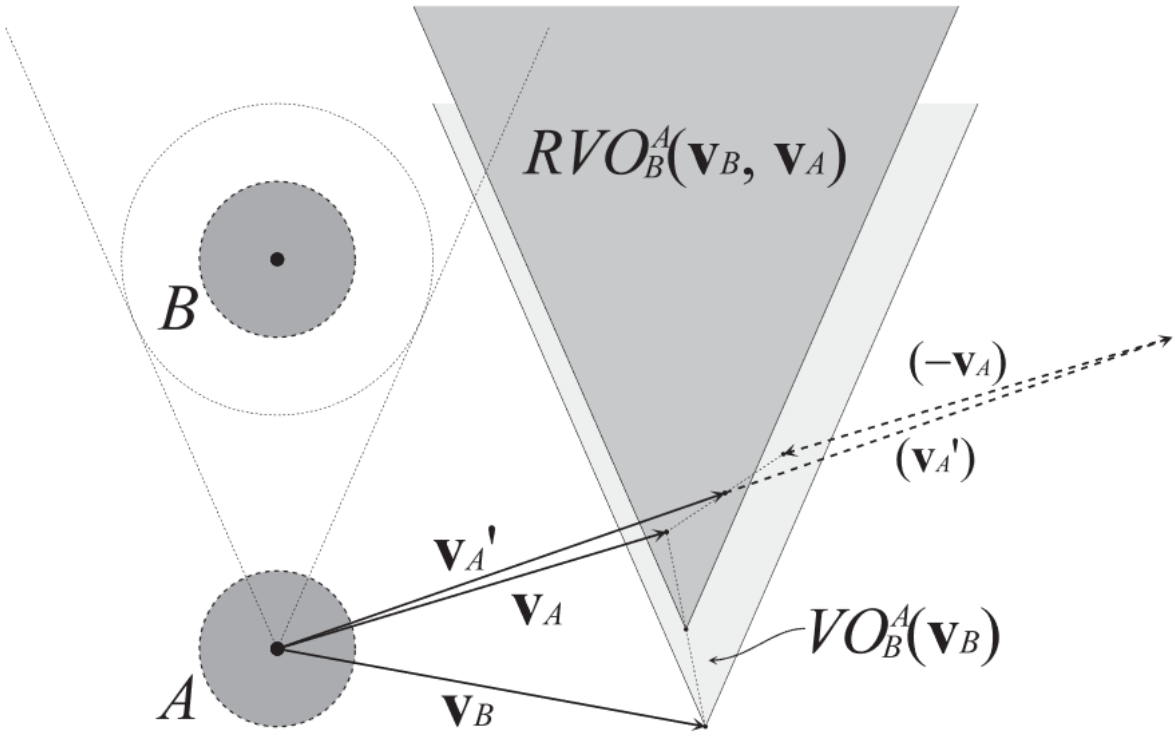


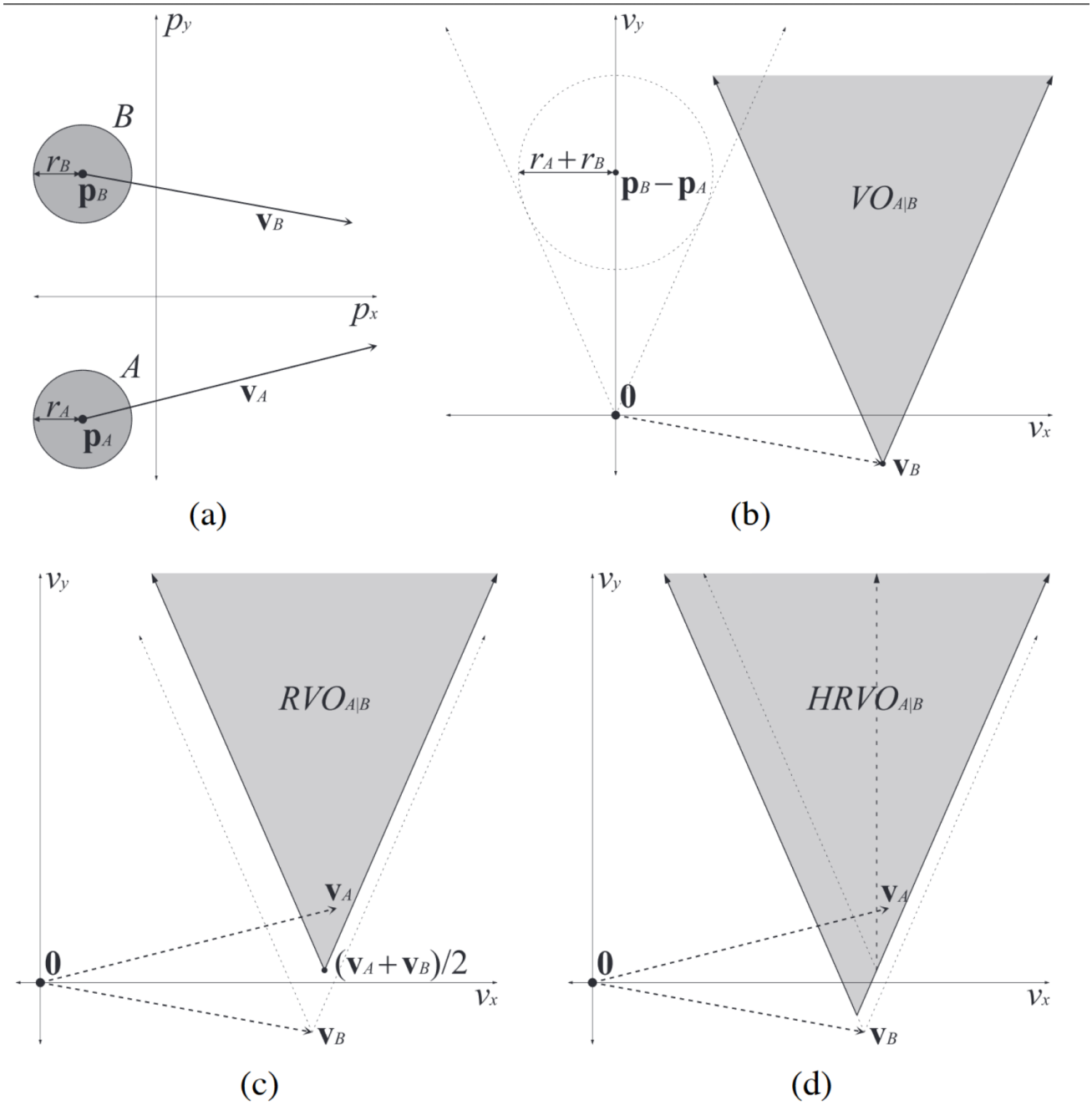
Fig. 4. The Reciprocal Velocity Obstacle $RVO_B^A(\mathbf{v}_B, \mathbf{v}_A)$ of agent B to agent A.

Definition 5 (Reciprocal Velocity Obstacle).

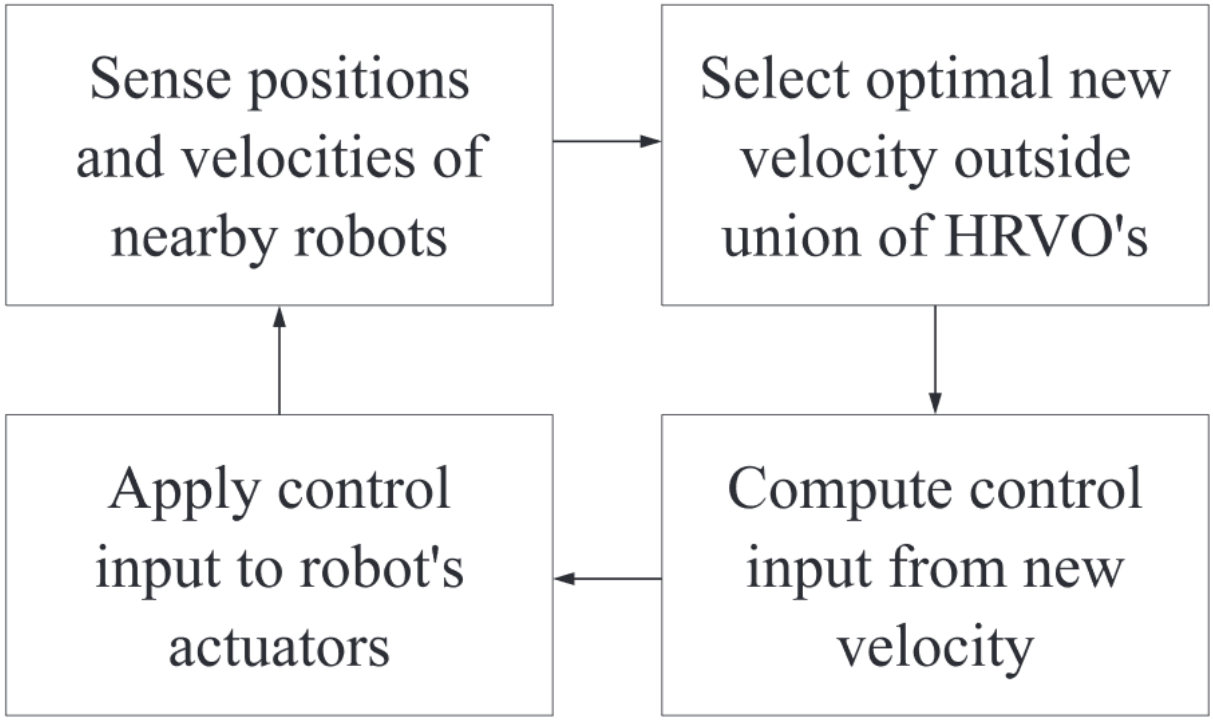
$$RVO_B^A(\mathbf{v}_B, \mathbf{v}_A) = \{\mathbf{v}'_A \,|\, 2\mathbf{v}'_A - \mathbf{v}_A \in VO_B^A(\mathbf{v}_B)\}.$$

- 要求：A,B同侧

- HRVO
  - 解决RVO 出现“reciprocal dance”的问题
    - AB双方速度选择相反侧，导致碰撞或不能通行或死锁
  - 左侧以VO为界，右侧以RVO为界 使得出现RVO的情况总是在右侧，对于多个机器人也就是总会在同侧执行RVO，这样不会出现“reciprocal dance”


p_y
B
r_B
$\mathbf{p}_B$
$\mathbf{v}_B$
p_x
A
r_A
$\mathbf{p}_A$
$\mathbf{v}_A$
(a)
v_y
r_A+r_B
$\mathbf{p}_B-\mathbf{p}_A$
$VO_{A|B}$
$\mathbf{0}$
v_x
$\mathbf{v}_B$
(b)
v_y
$RVO_{A|B}$
$\mathbf{v}_A$
$\mathbf{0}$
$(\mathbf{v}_A+\mathbf{v}_B)/2$
v_x
$\mathbf{v}_B$
(c)
v_y
$HRVO_{A|B}$
$\mathbf{v}_A$
$\mathbf{0}$
v_x
$\mathbf{v}_B$
(d)

- VO算法的使用
  - 流程图



- 注意问题：
  - 传感器的不确定性
    - 卡尔曼滤波
  - 速度选择
    - 在规定时间τ内，满足运动学约束