CS230
Game Implementation Techniques

Lecture 17b

Overview

- Animated Circle to Line Segment
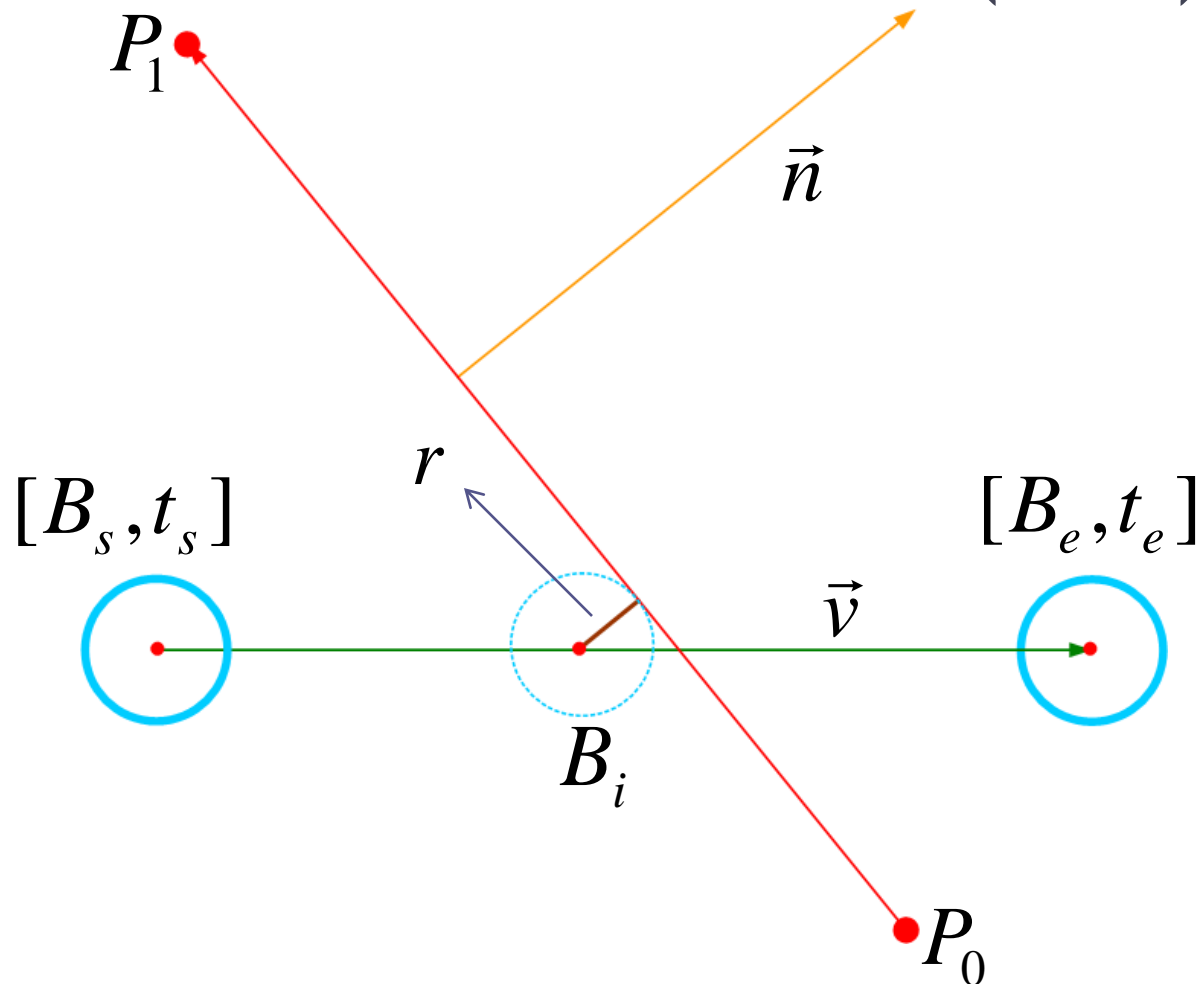
Modeling Pinball as Circle

- Pinball modeled by a circle with center and radius r
- Located at center point B_s at top of frame
- Moving in direction given by normalized vector $\vec{v}$ and speed k units

$$B(t) = B_s + k\hat{v}t, t \in [0,1]$$

- Velocity per **frame** $\quad \vec{v} = \overrightarrow{B_s B_e}$

$$\Rightarrow B(t) = B_s + \vec{v}t, t \in [0,1]$$

Pinball–Wall Intersection (1/3)

P_1

$\vec{n}$

r

$[B_s, t_s]$

$[B_e, t_e]$

$\vec{v}$

B_i

P_0

Pinball–Wall Intersection (2/3)

Wall modeled as

$$L : \vec{n} \bullet P - \vec{n} \bullet P_0 = D_2$$

P_1

$\vec{n}$

$\hat{n} \bullet B_e - \hat{n} \bullet P_0$

r

$[B_s, t_s]$

B_i

$\vec{v}$

$[B_e, t_e]$

$\hat{n} \bullet B_s - \hat{n} \bullet P_0$
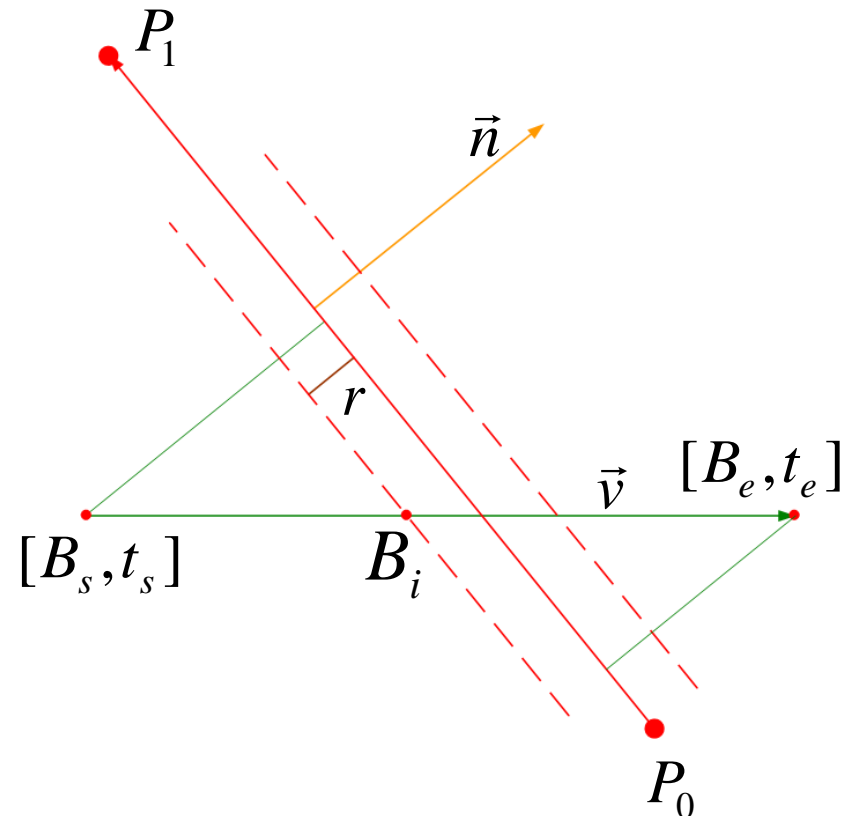
P_0
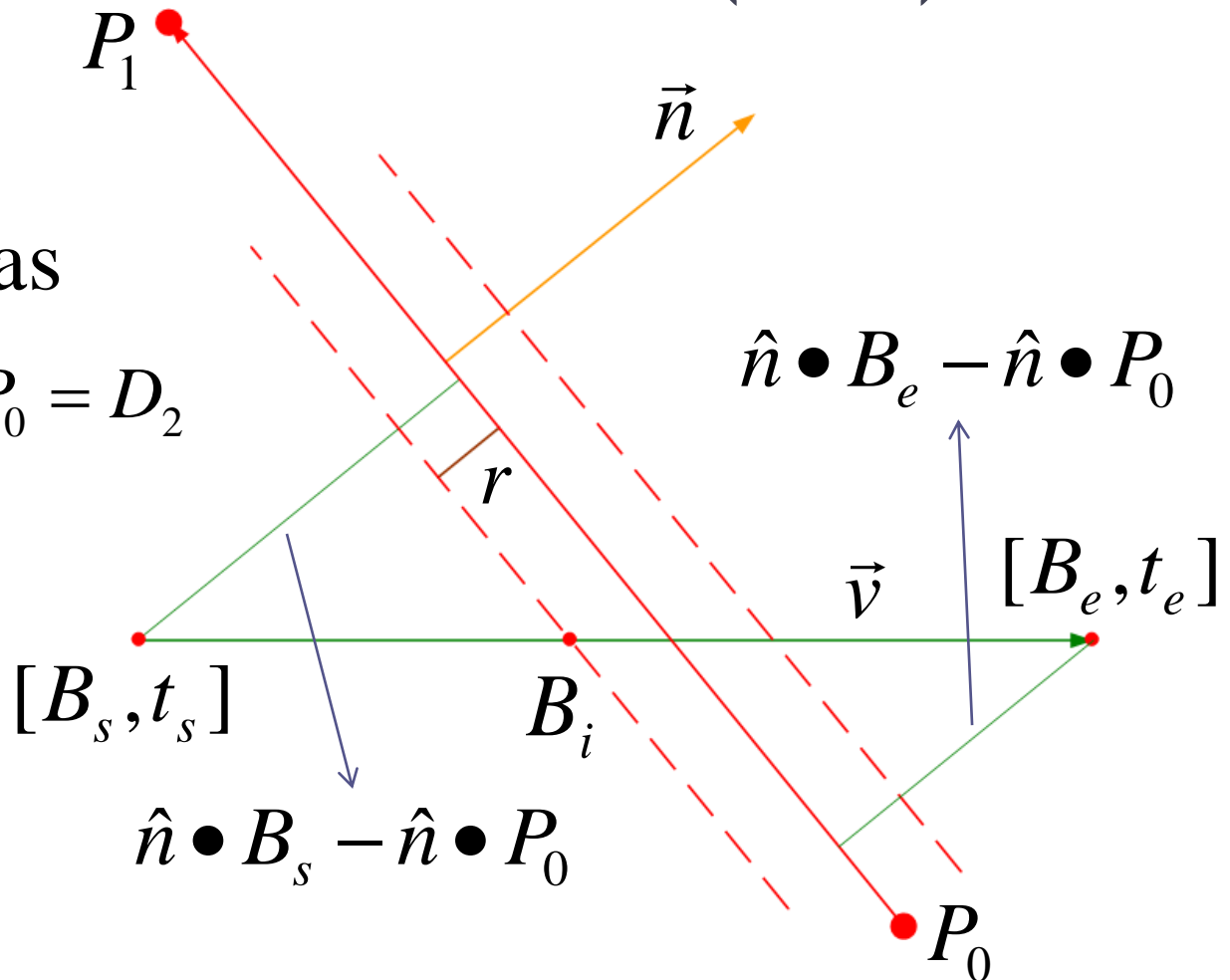
Pinball-Wall Intersection (3/3)

Pinball is inside at t_s and outside at t_e

$$t_i = \frac{\hat{n} \bullet P_0 - \hat{n} \bullet B_s + D_2}{\hat{n} \bullet \vec{v}}$$
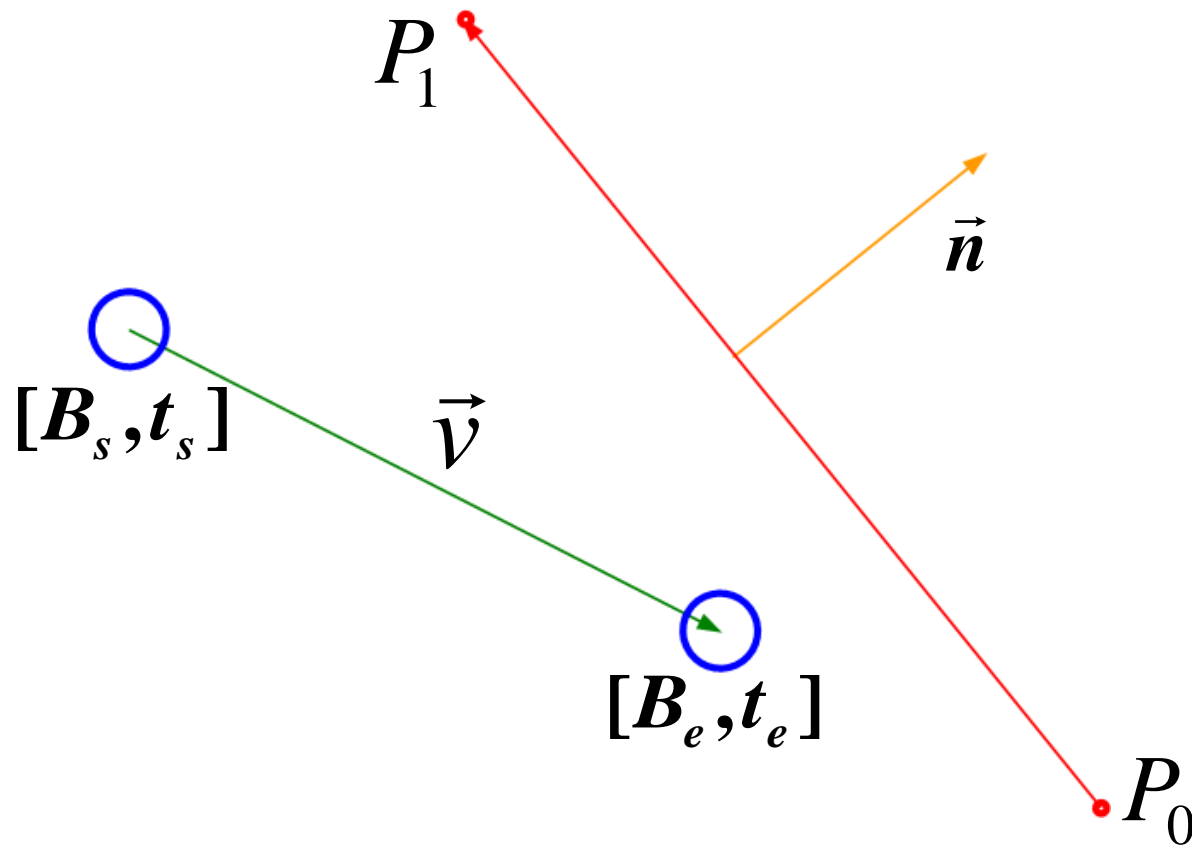
where $\qquad t_i \in [0,1]$

$$B_i = B_s + \vec{v}\left(\frac{\hat{n} \bullet P_0 - \hat{n} \bullet B_s + D_2}{\hat{n} \bullet \vec{v}} \right)$$

Note: $D_2 = -r$ when B_s is inside
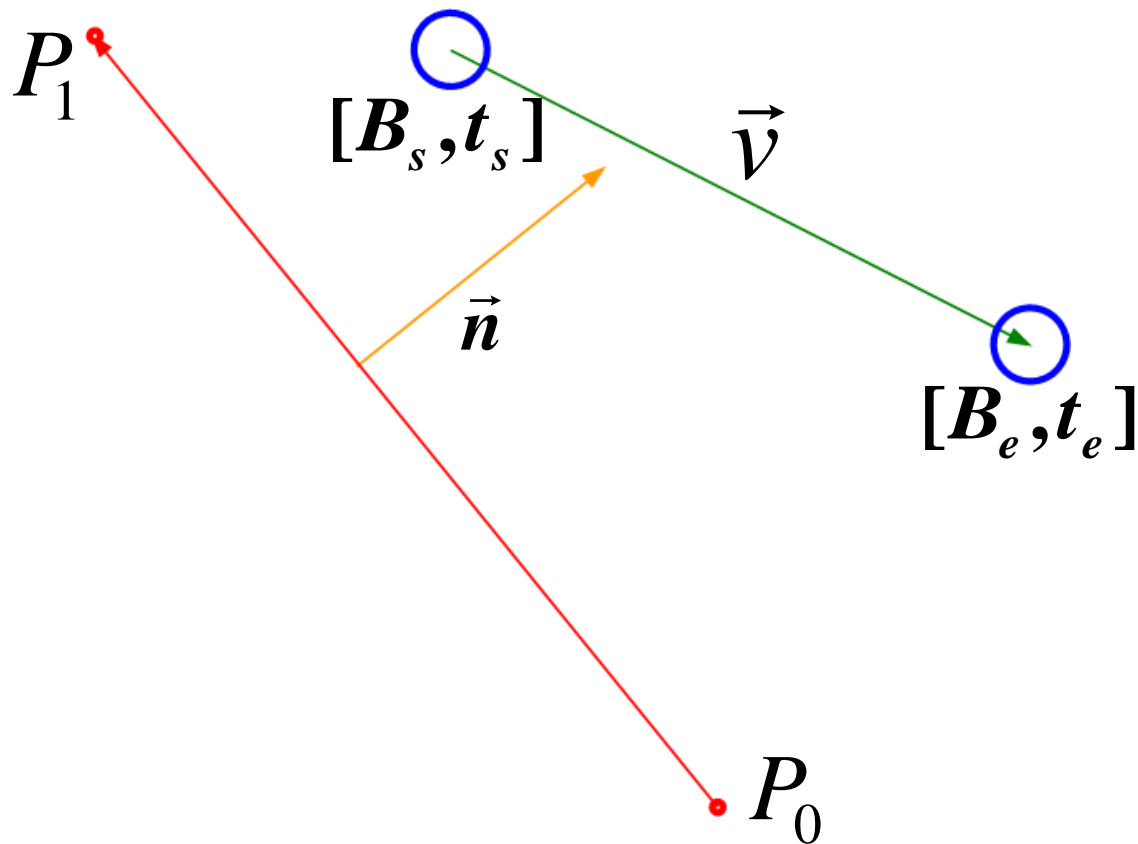$\qquad\quad D_2 = r$ when B_s is outside

P_1

$\vec{n}$

r

$\vec{v}$ $[B_e, t_e]$

$[B_s, t_s]$ B_i

P_0

Test for Non-Collision (1/4) **Not to be used**

$$\left(\hat{n} \bullet B_s - \hat{n} \bullet P_0 < -r\right) \&\& \left(\hat{n} \bullet B_e - \hat{n} \bullet P_0 < -r\right)$$

P_1

$\vec{n}$

$[B_s, t_s]$

$\vec{v}$

$[B_e, t_e]$

P_0

Test for Non-Collision (2/4)

Not to be used

$$\left(\hat{n} \bullet B_s - \hat{n} \bullet P_0 > r \right) \& \& \left(\hat{n} \bullet B_e - \hat{n} \bullet P_0 > r \right)$$

P_1

$[B_s, t_s]$

$\vec{v}$

$\vec{n}$

$[B_e, t_e]$

P_0

Test for Non-Collision (3/4)

Not to be used

$$(B_i - P_1) \bullet (P_0 - P_1) < 0$$

$[B_s, t_s]$

$[B_e, t_e]$

$\vec{v}$

$[B_i, t_i]$
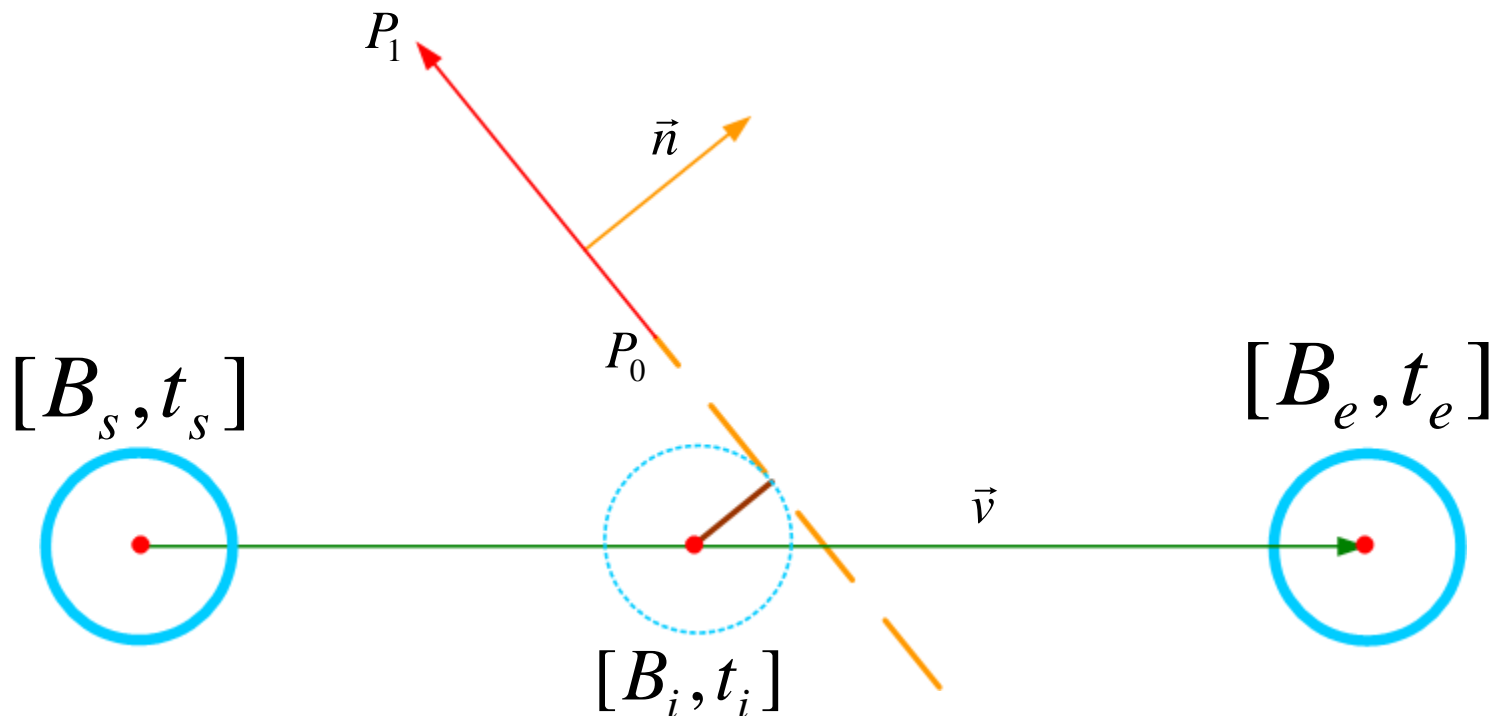
P_1

$\vec{n}$

P_0
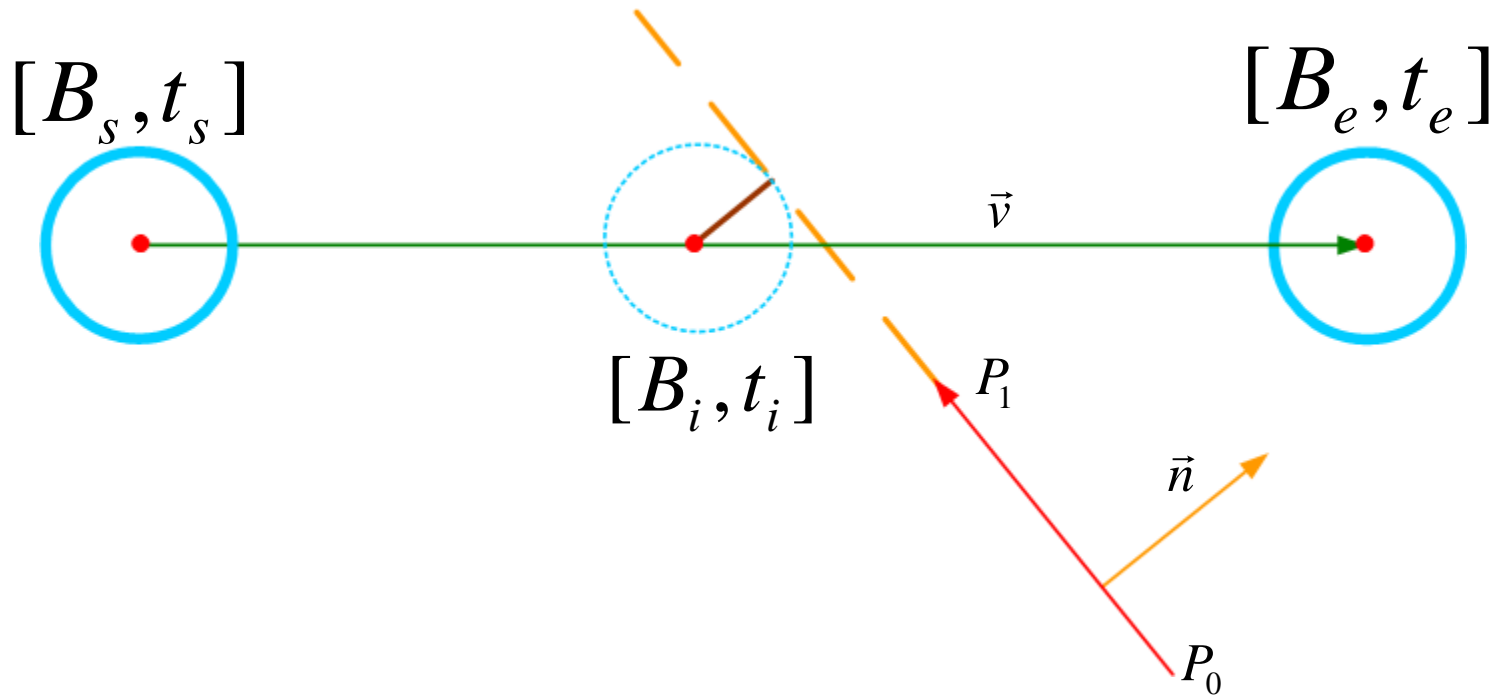
Ball collides with infinite extension of wall... not finite wall!

Test for Non-Collision(4/4)

Not to be used

$$(B_i - P_0) \bullet (P_1 - P_0) < 0$$
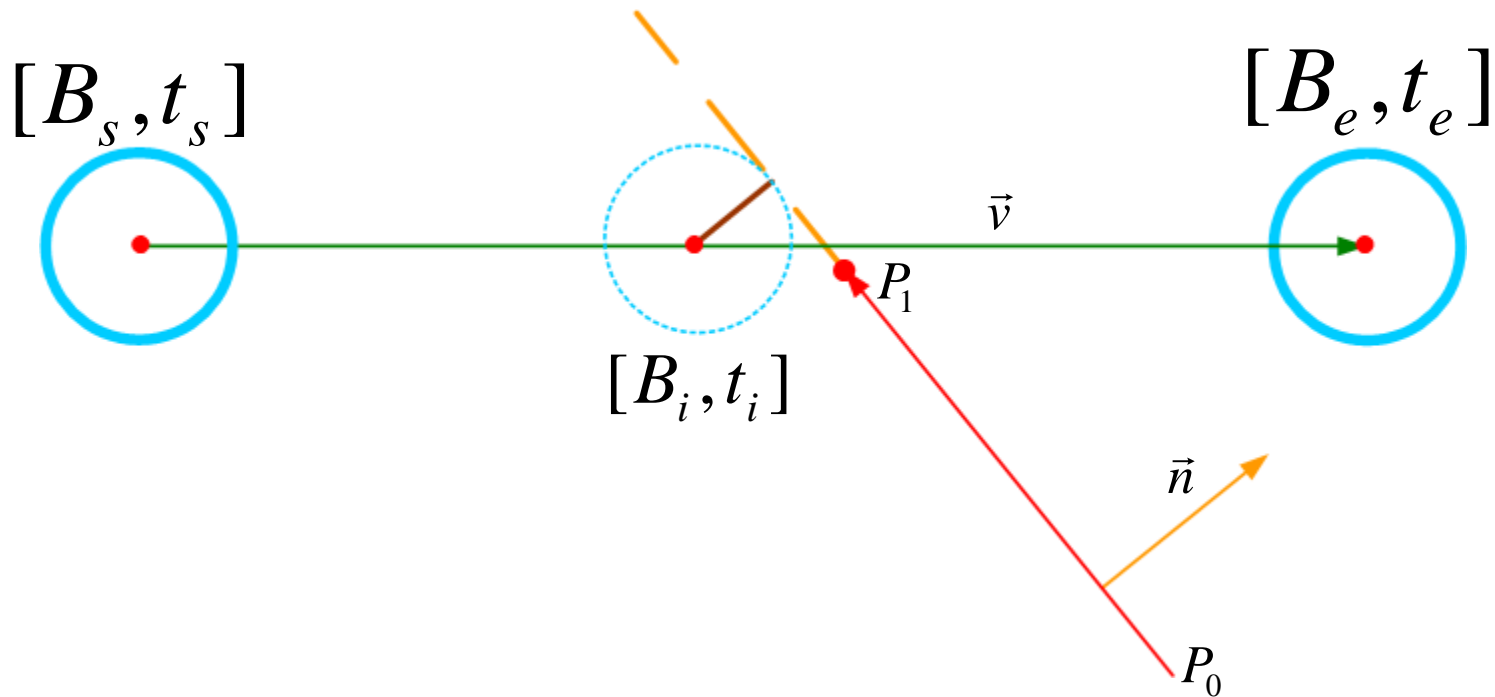
P_1

$\vec{n}$

P_0

$[B_s, t_s]$

$[B_e, t_e]$

$\vec{v}$

$[B_i, t_i]$

Ball collides with infinite extension of wall… not finite wall!

But! We have a Problem

The intersection point B_i is not on the line, but the ball collides with the wall.

$$[B_s, t_s]$$

$$[B_e, t_e]$$

$$\vec{v}$$

$$P_1$$

$$[B_i, t_i]$$

$$\vec{n}$$

$$P_0$$

Steps

- Check for trivial rejection
  - ▫ B_s, B_e inside or both outside
  - ▫ Going from inside to outside and the collision type of the line segment is outside, and vice versa.
- Calculate the point and time of intersection
  - ▫ Check if the time is between t_s and t_e
- Check if the point of intersection is on the line segment

Not to be used
We're going to see a better algorithm with more steps