# Optimum Design of Side mirror

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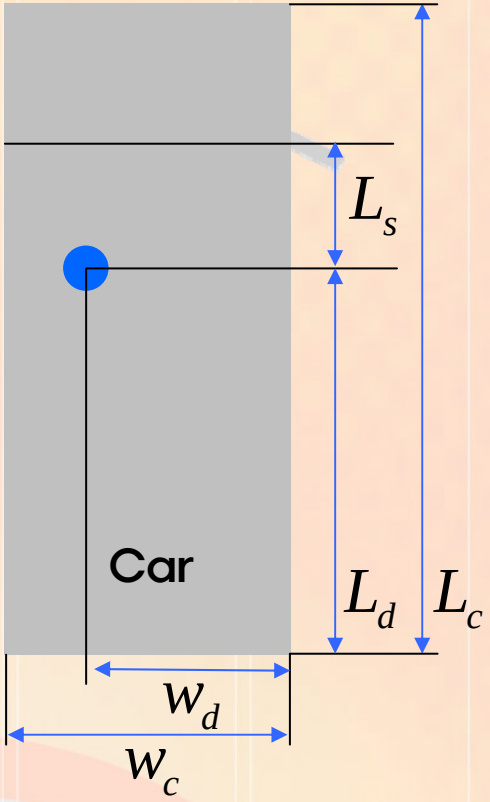
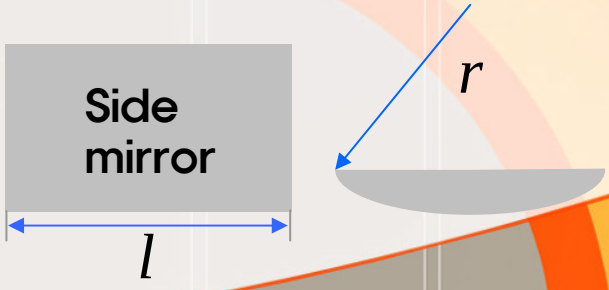
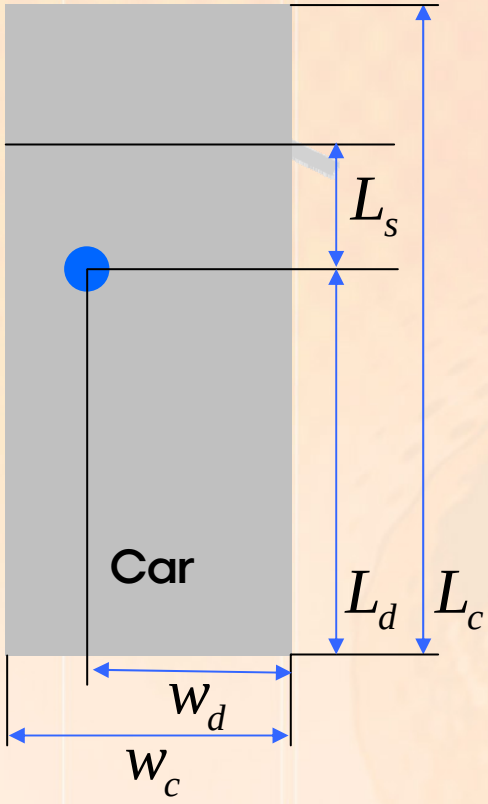
# Modeling

직사각형으로 모델링



# Step2 : Data and information collection




$w_c$ = 자동차 폭 : 1800 *mm*

$L_c$ = 자동차 길이 : 4650 *mm*

$L_d$ = 운전자와 자동차 뒷 범퍼까지 거리 : 2350 *mm*

$L_s$ = 운전자와 side mirror까지 세로 거리 : 600 *mm*

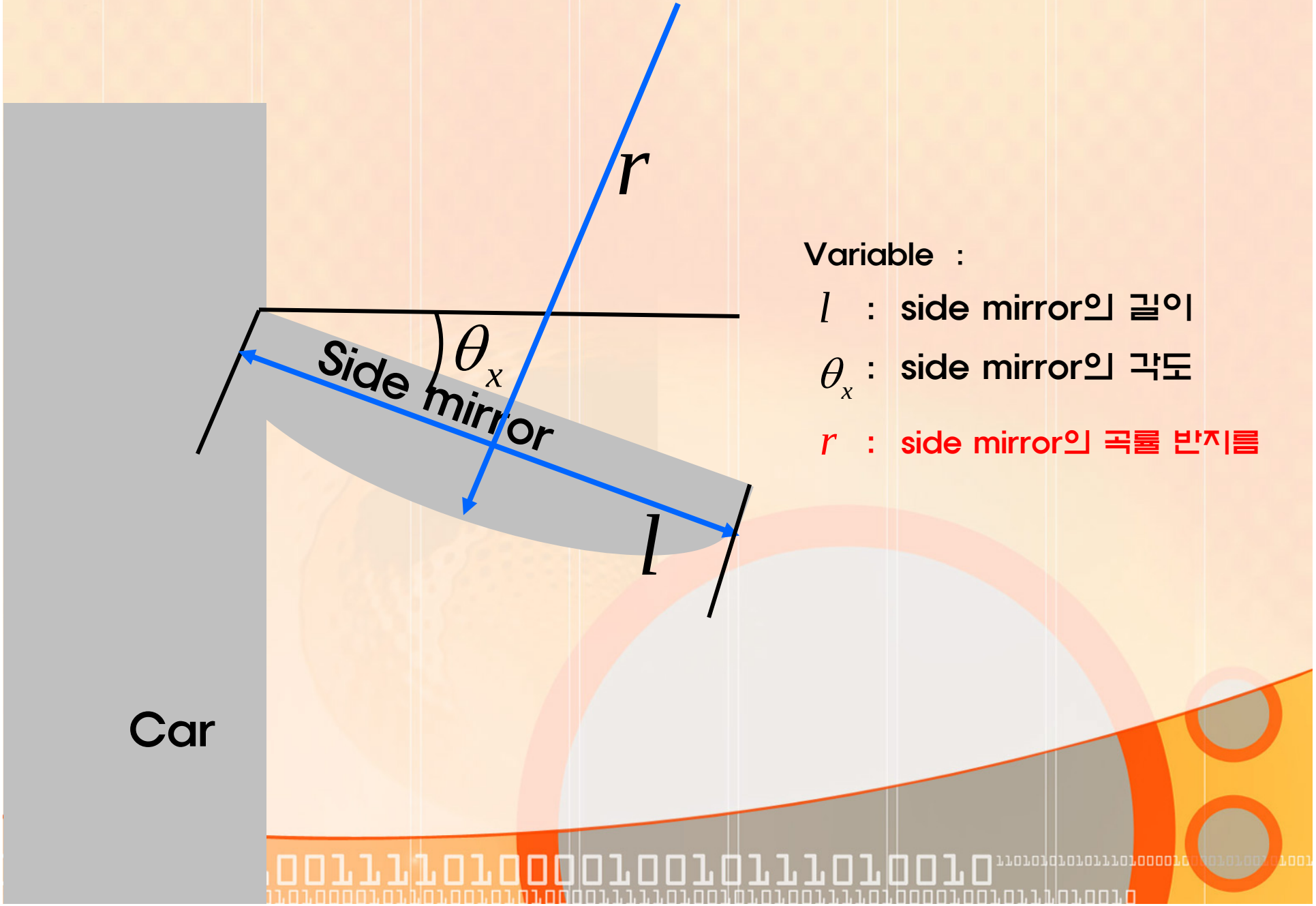
$w_d$ = 운전자와 side mirror까지 가로 거리 : 1100 *mm*

$w_L$ = 도로 폭 길이 : 3500 *mm*

$L_{ss}$ = 관측거리 : 50 *m*

(New marcia 기준)

# Step3 : Identification/Definition



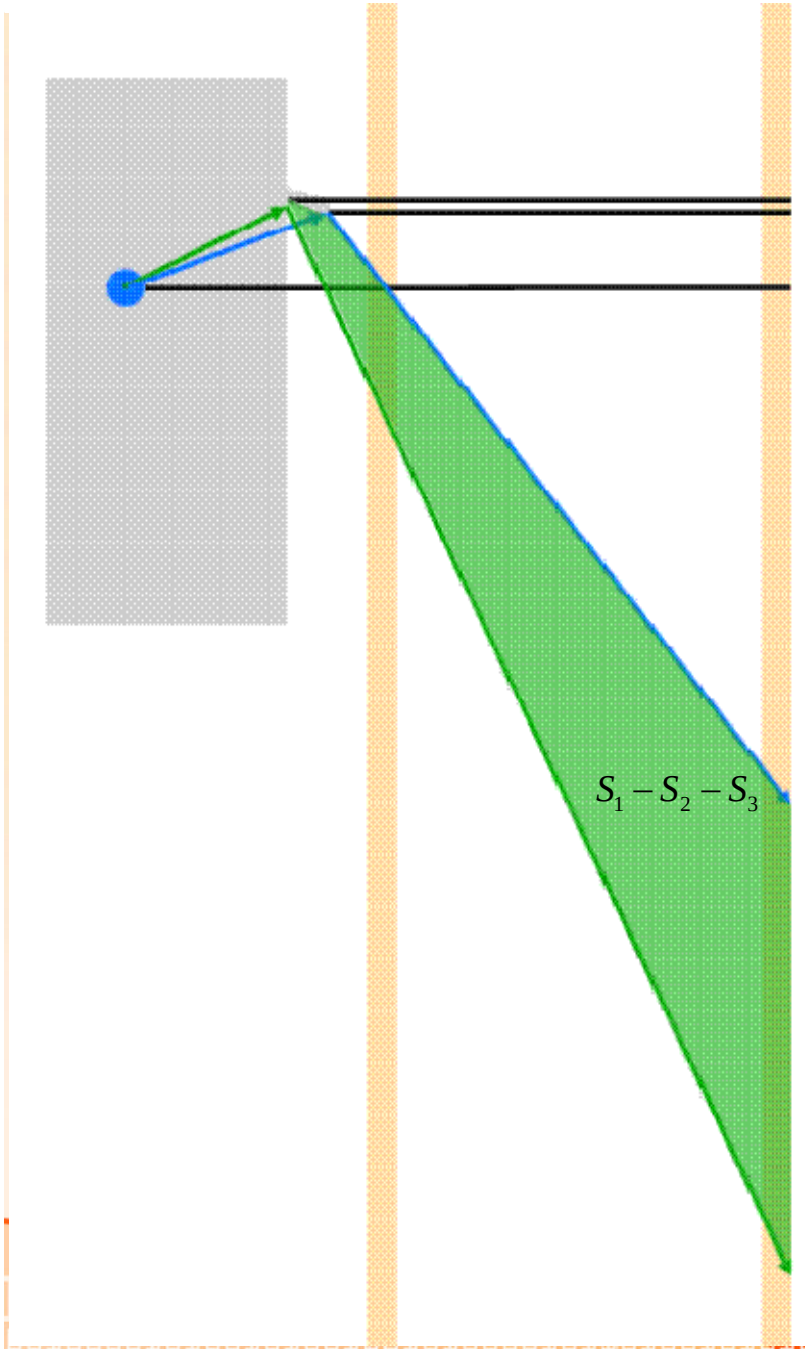

Variable :

$l$ : side mirror의 길이

$\theta_x$ : side mirror의 각도

$r$ : side mirror의 곡률 반지름

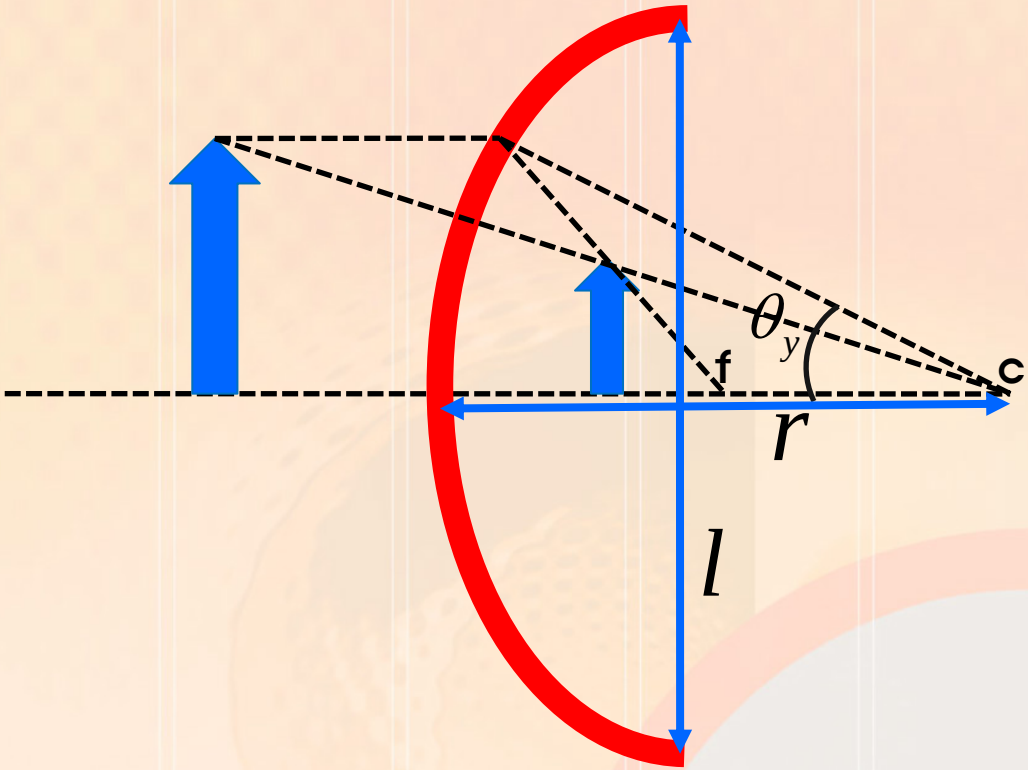
# Step4 : Identification of a Criterion to Be Optimized




Minimize :

$$f = S_1 - S_2 - S_3$$

# Step4 : Identification of a Criterion to Be Optimized




$$\theta_y = \sin^{-1}\frac{l}{2r}$$

# Step4 : Identification of a Criterion to Be Optimized

$$f = S_1 - S_2 - S_3$$

$$S_1 = \frac{\tan\left(\frac{\pi}{2} - \theta_1 + 2\theta_x + 2\theta_y\right)\left(\frac{3}{2}w_L - \frac{w_c}{2}\right)^2}{2}$$

$$S_2 = \frac{\tan\left(\frac{\pi}{2} - \tan^{-1}\left(\frac{w_d + l\cos\theta_x}{L_s - l\sin\theta_x}\right) + 2\theta_x - 2\theta_y\right)\left(\frac{3}{2}w_L - \frac{w_c}{2} - l\cos\theta_x\right)^2}{2}$$

$$S_3 = \frac{(3w_L - w_c - l\cos\theta_x)}{2} l\sin\theta_x$$

$$f = \frac{\tan\left(\frac{\pi}{2} - \theta_1 + 2\theta_x + 2\theta_y\right)\left(\frac{3}{2}w_L - \frac{w_c}{2}\right)^2}{2} - \frac{\tan\left(\frac{\pi}{2} - \tan^{-1}\left(\frac{w_d + l\cos\theta_x}{L_s - l\sin\theta_x}\right) + 2\theta_x - 2\theta_y\right)\left(\frac{3}{2}w_L - \frac{w_c}{2} - l\cos\theta_x\right)^2}{2} - \frac{(3w_L - w_c - l\cos\theta_x)}{2} l\sin\theta_x$$

# Step5 : Identification of Constraints

- 자동차 면에 대한 제약조건

$$\theta_x \le \frac{\theta_1}{2} - \theta_y$$

- 관측거리에 대한 제약조건

$$\theta_x \ge \frac{1}{2}\left(\theta_1 - 2\theta_y - \tan^{-1}\frac{w_c}{L_{ss} + L_s + L_d}\right)$$

- 도로 폭에 대한 제약조건

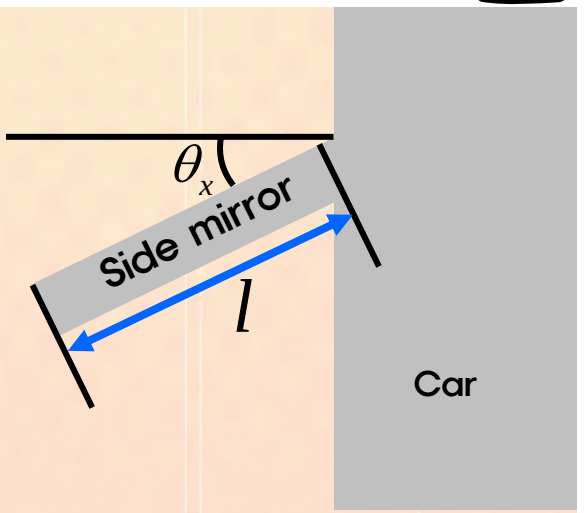
$$l \le \frac{\left(w_L - w_c\right)}{2\cos\theta_x}$$

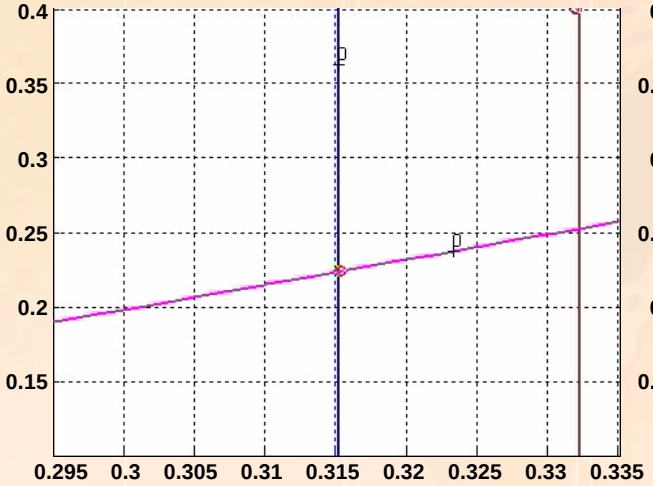
- 옆 차선 자동차에 대한 제약조건

$$l \ge \frac{w_L - w_c - \tan\theta_p^{`}\left(L_s + L_c\right)}{\cos\theta_x - \sin\theta_x \tan\theta_p^{`}}$$

# Result(Left_method)

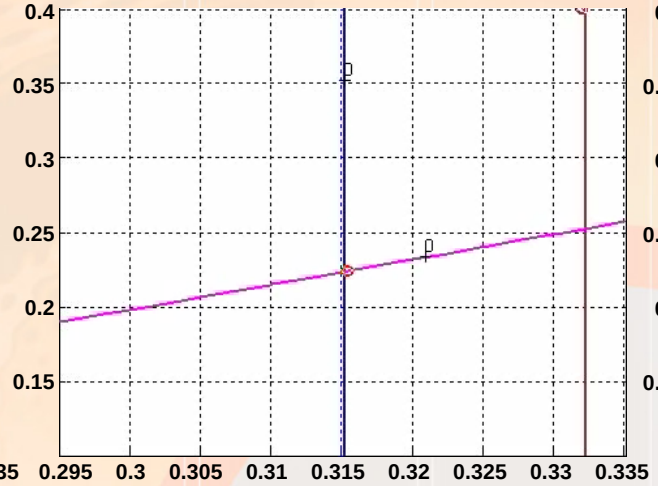
| •결과값 | •실제값 |
| --- | --- |
| Set_x=0.3153 rad<br>( 18.065 ° )<br>L=0.2237 m | Set_x= ? rad<br>( ? ° )<br>L=0.18 m |




< fmincon >

19번

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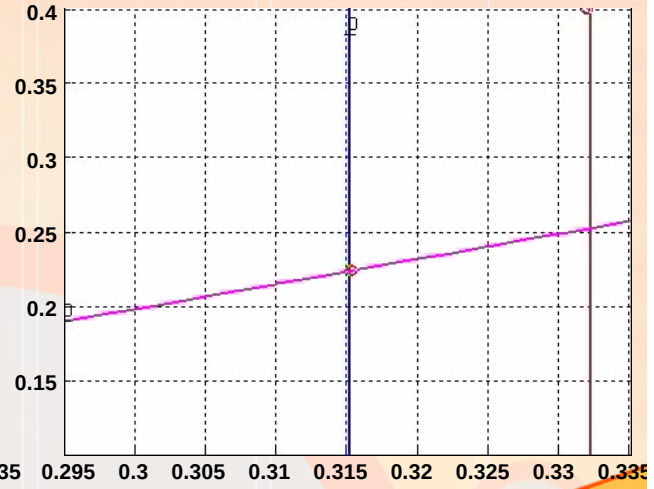
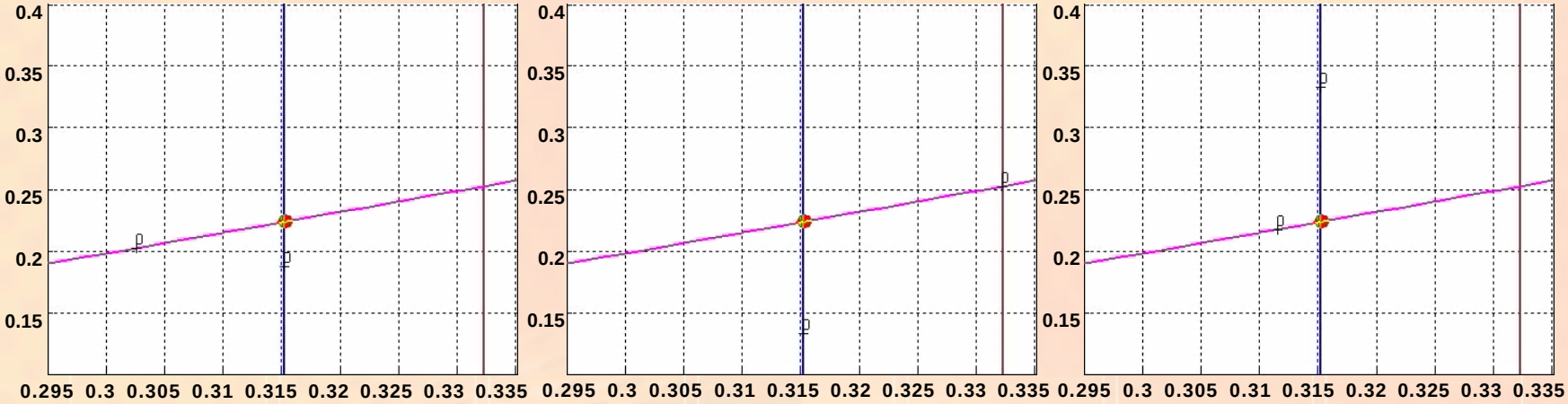
30번




< fminimax >

5번

# Result(Left_initial)



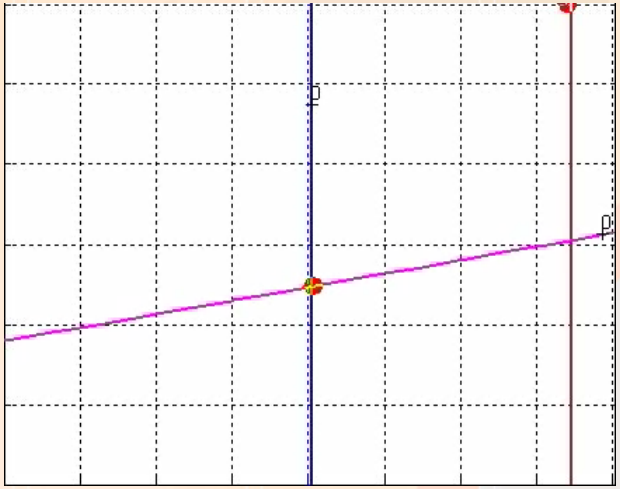

[0, 0] :5번




[0.6, 0.6] :4번




[2, 2] :10번



[0.332, 0.4] :19번

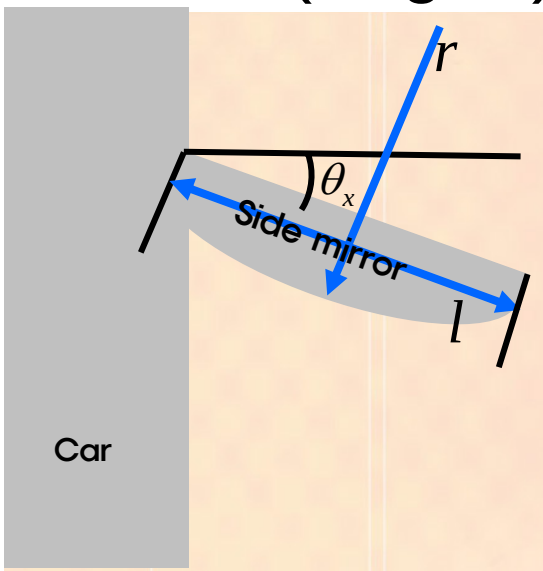
•결과값

Set_x=0.3153 rad

( 18.065 ° )

L=0.2237 m

# Result(Right)




| •결과값 | •실제값 |
| --- | --- |
| Set_x=0.385 rad | Set_x= ? rad |
| ( 22.06 ° ) | ( ? ° ) |
| L=0.164 m | L=0.18 m |
| r=0.6148 m | r=0.56 m |

- 최적값에 의한 view region