Young Researchers Seminar 2009

Torino, Italy, 3 to 5 June 2009

Measurement of variability involved in the car-following rules

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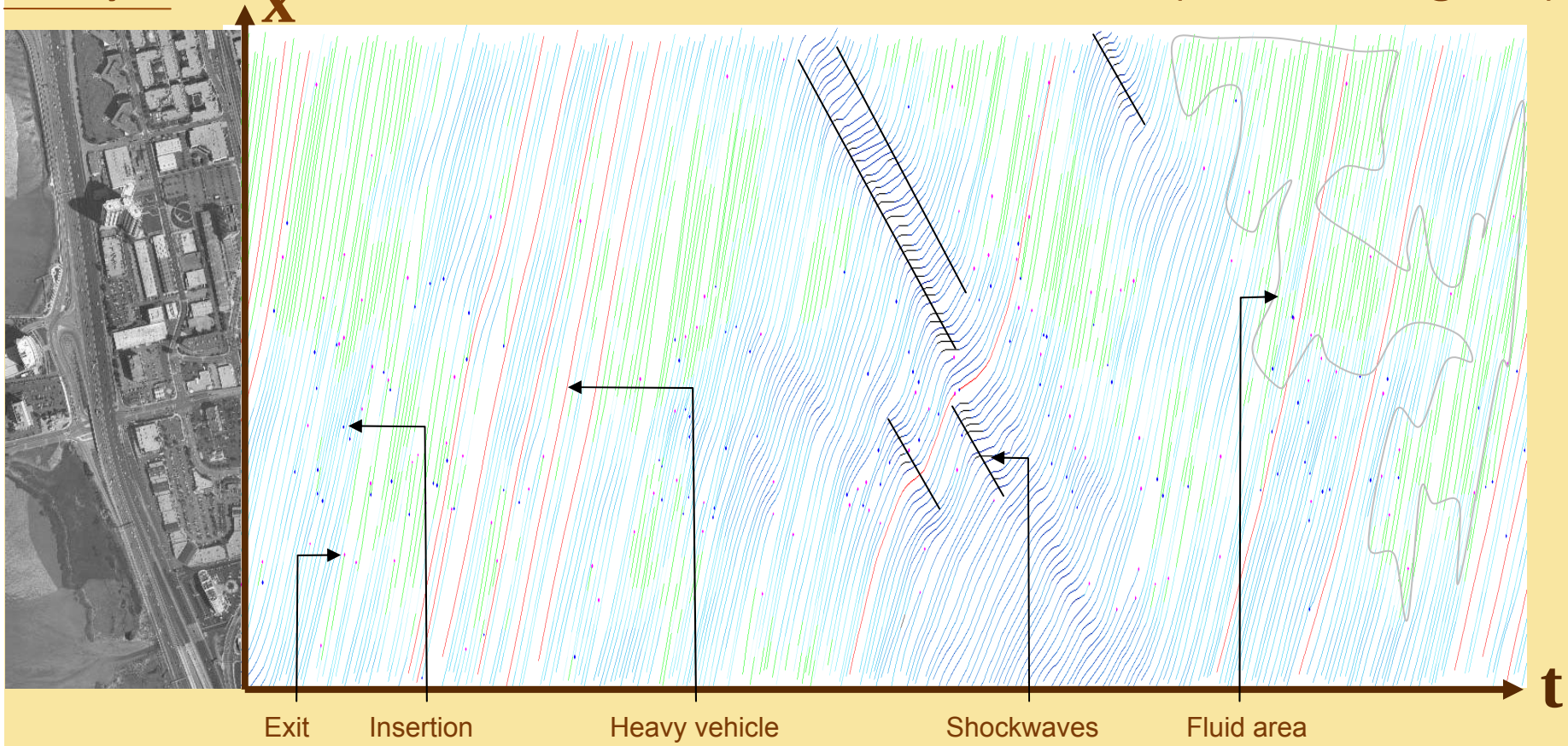
Context

- Empirical evidence = traffic stream is **heterogeneous**
- Developpement of **microscopic models**

➞ **Need to know the driver's behavior distribution**

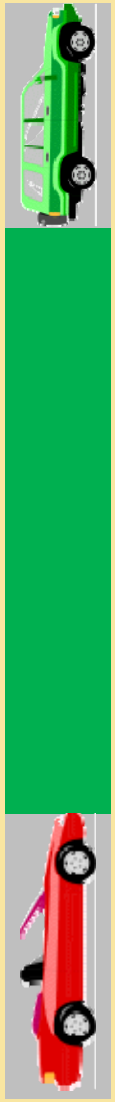
➞ **Need some microscopic data (trajectories)**

I80, USA (NGSIM Program)



Identification	Geometric characteristics	Trajectory	Surrounding conditions
Lane Id Vehicle Id	Class /Length Vehicle width	Position Time	Leader Id Follower Id

Car-following model



Large gap ⟶ free-flow

Car-following model

(i+1)

Small gap ⟶ Congestion

(i)

space ↑

Car-following model

(i+1)

(i)

v'

v'

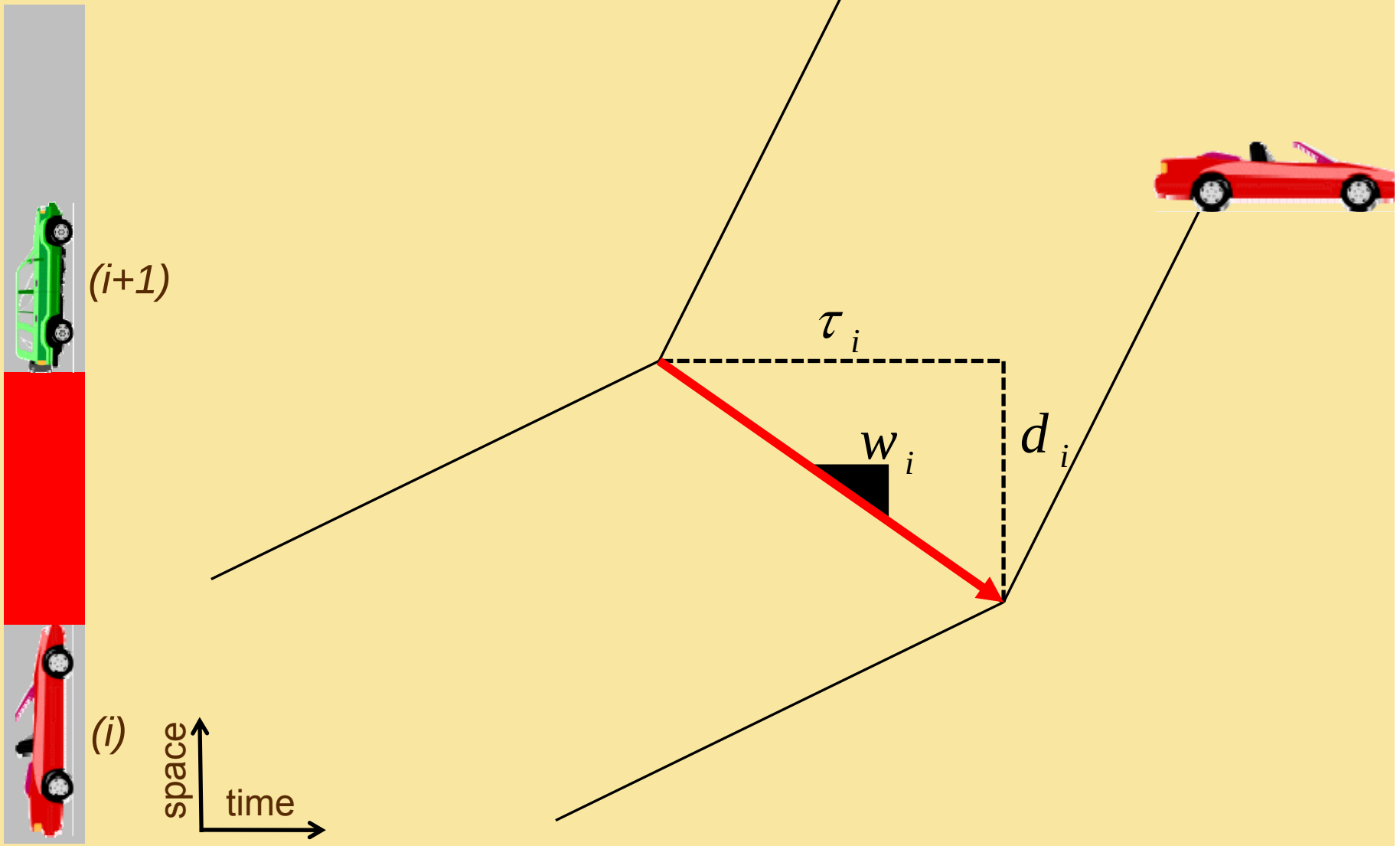
v

v

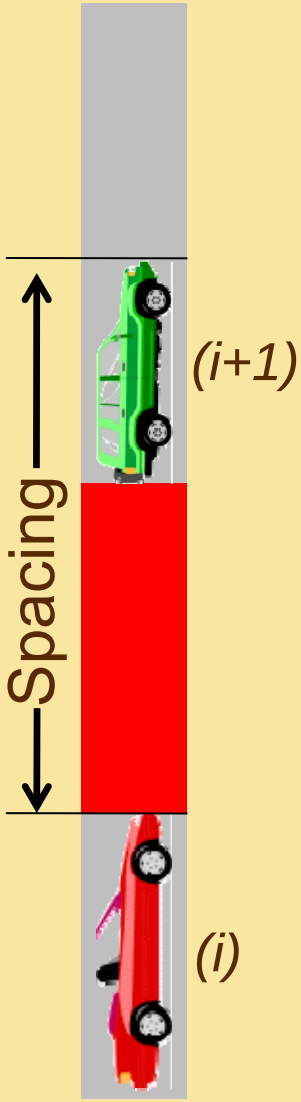
space

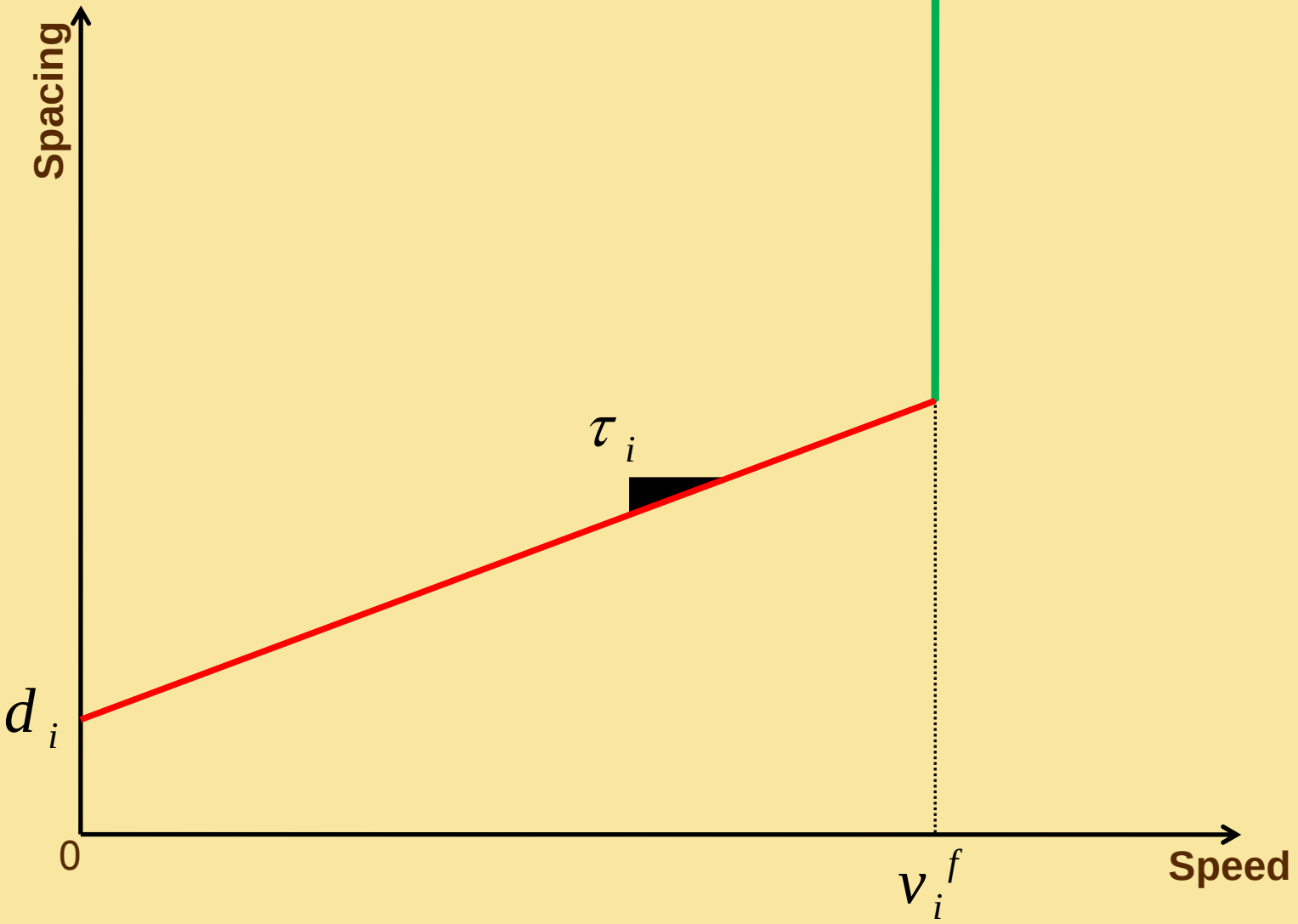
time

Car-following model

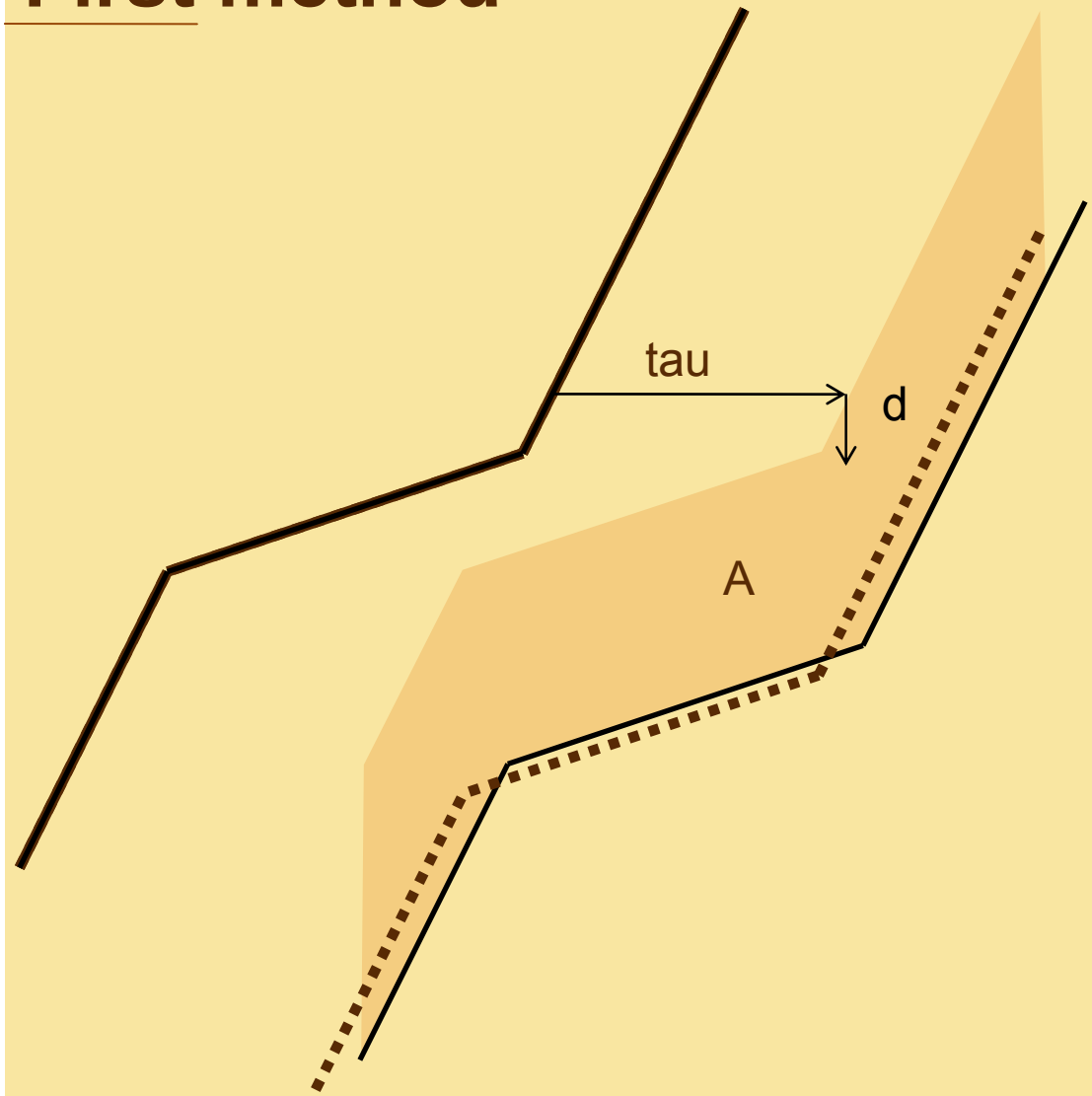


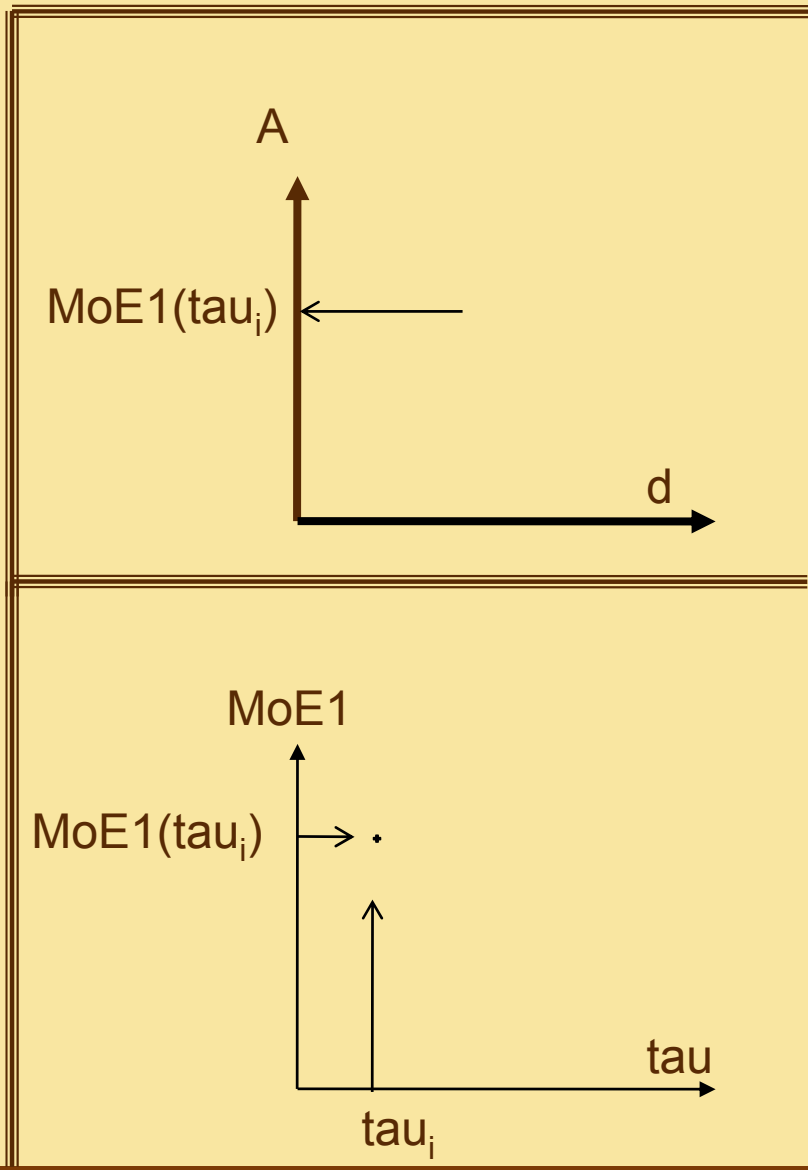
NEWELL Car-following model



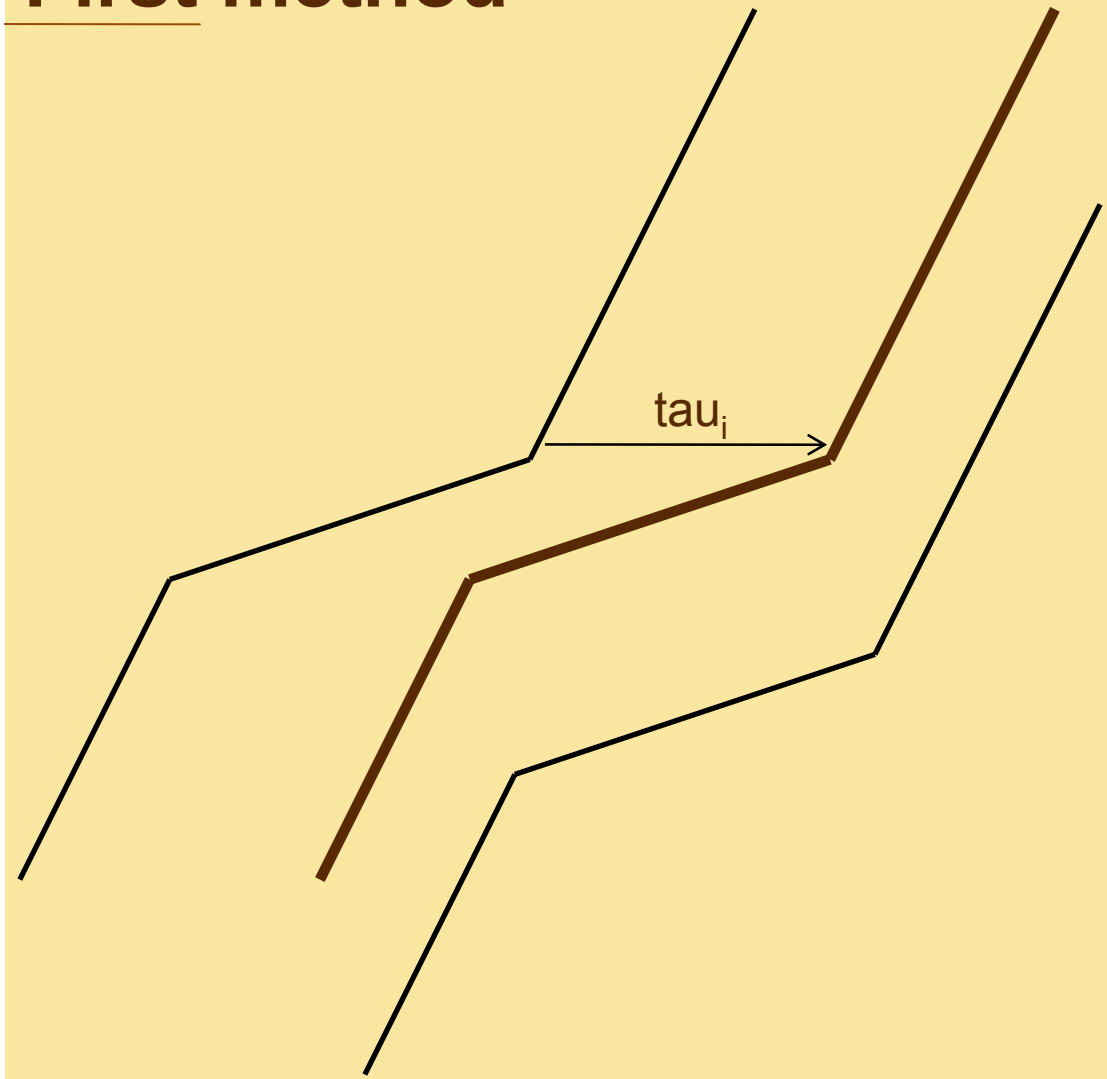


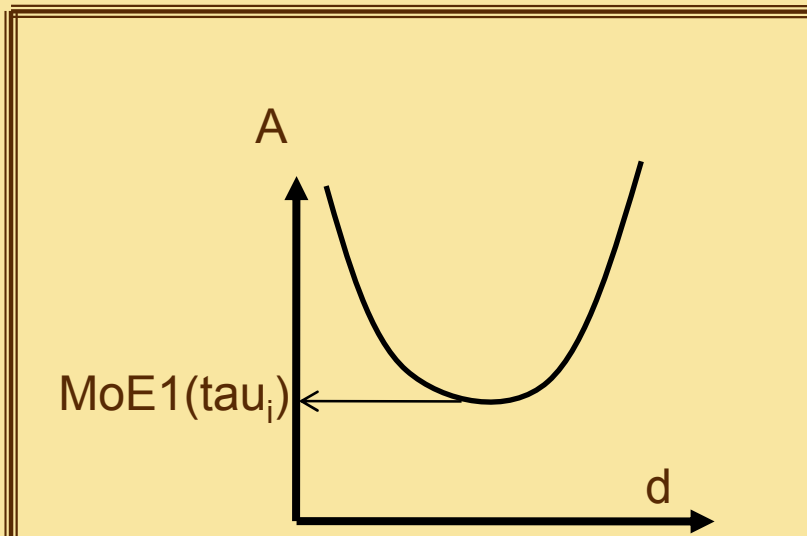
First method

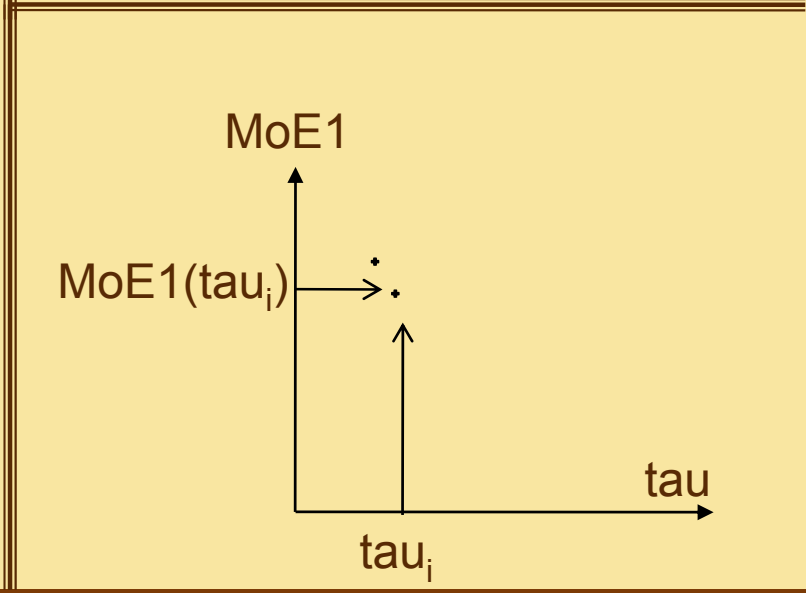




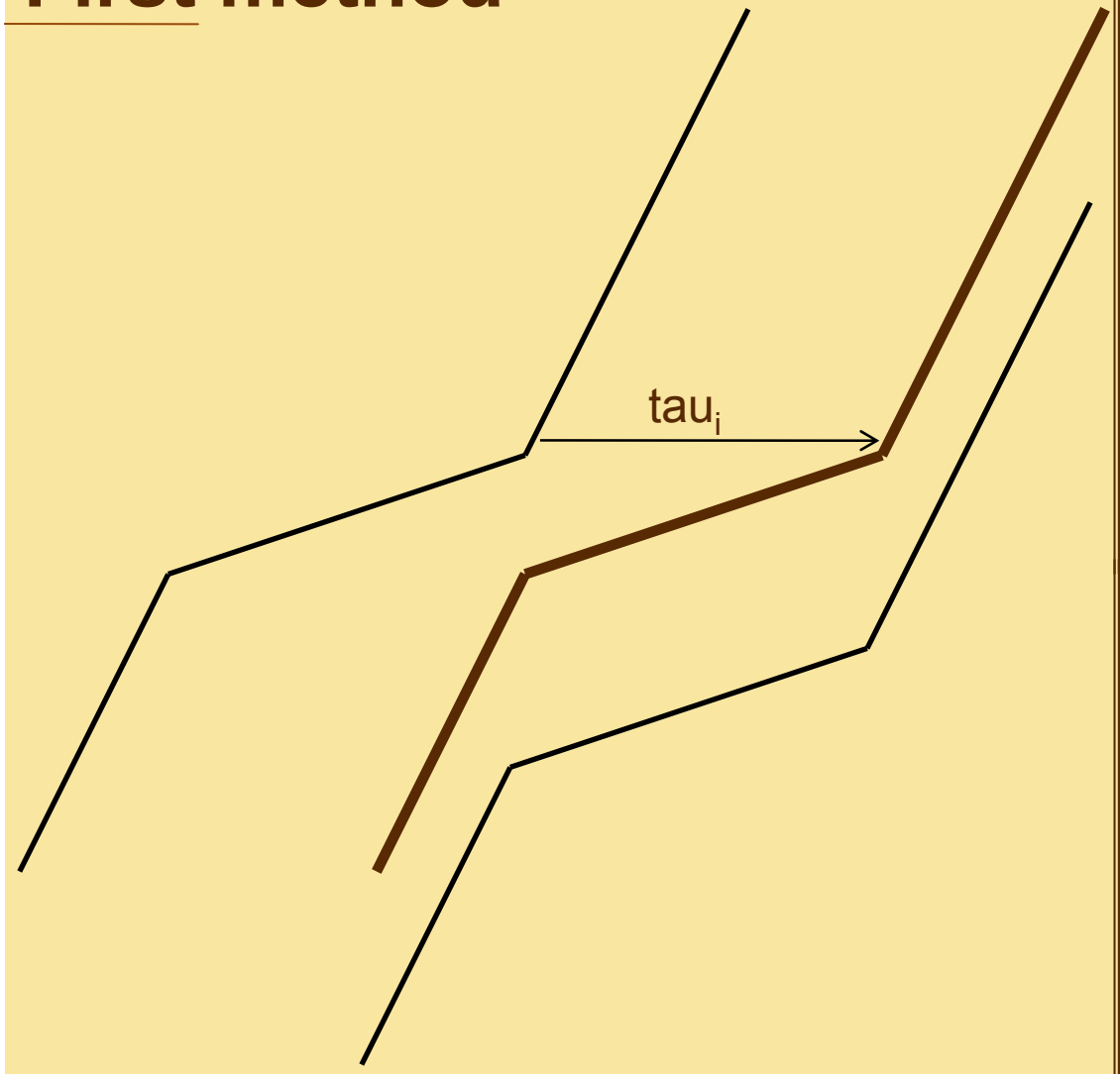
First method

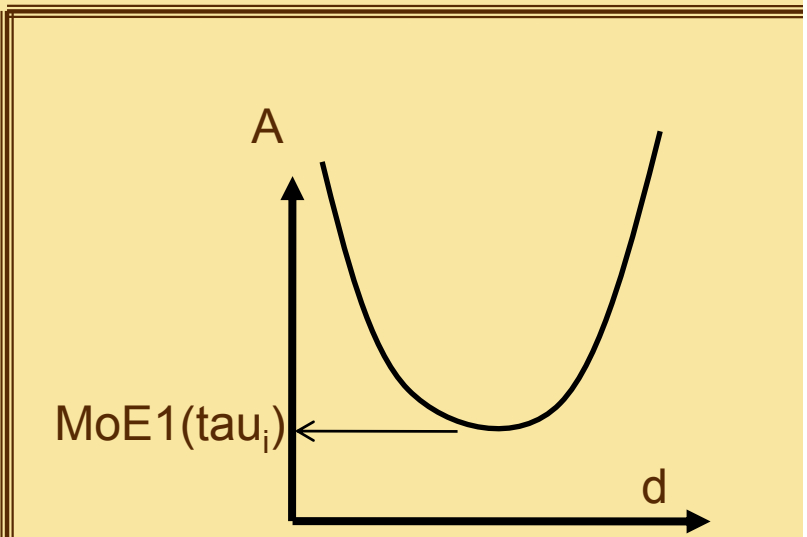


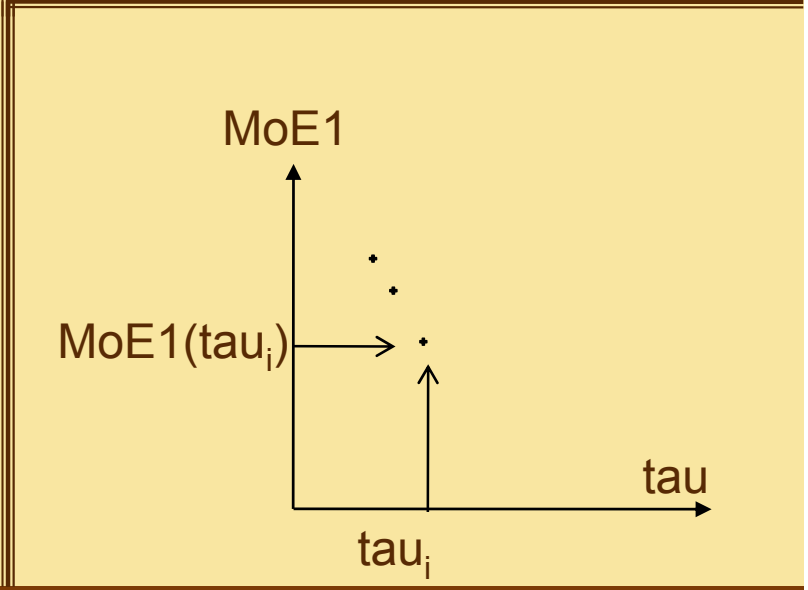




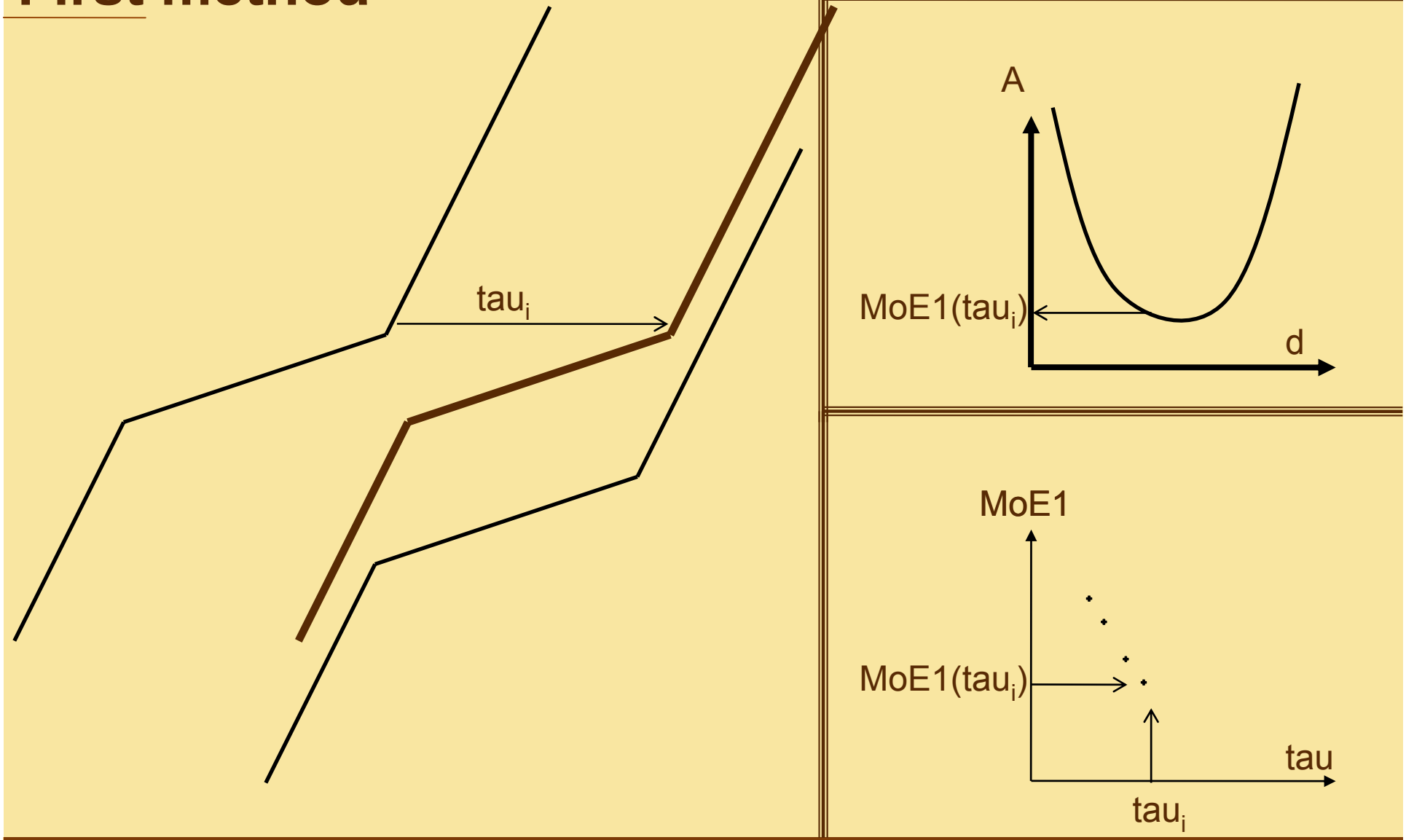
First method



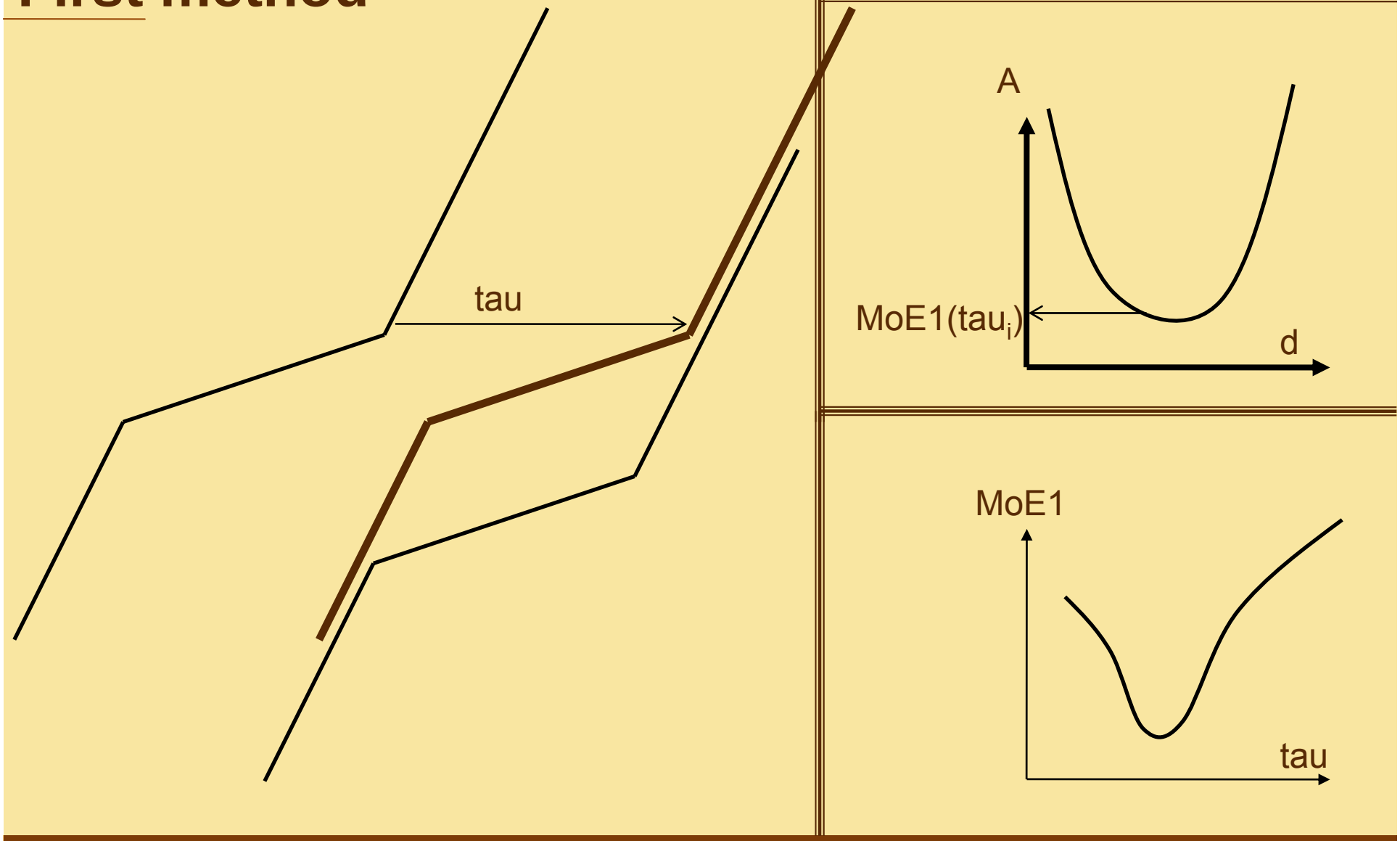




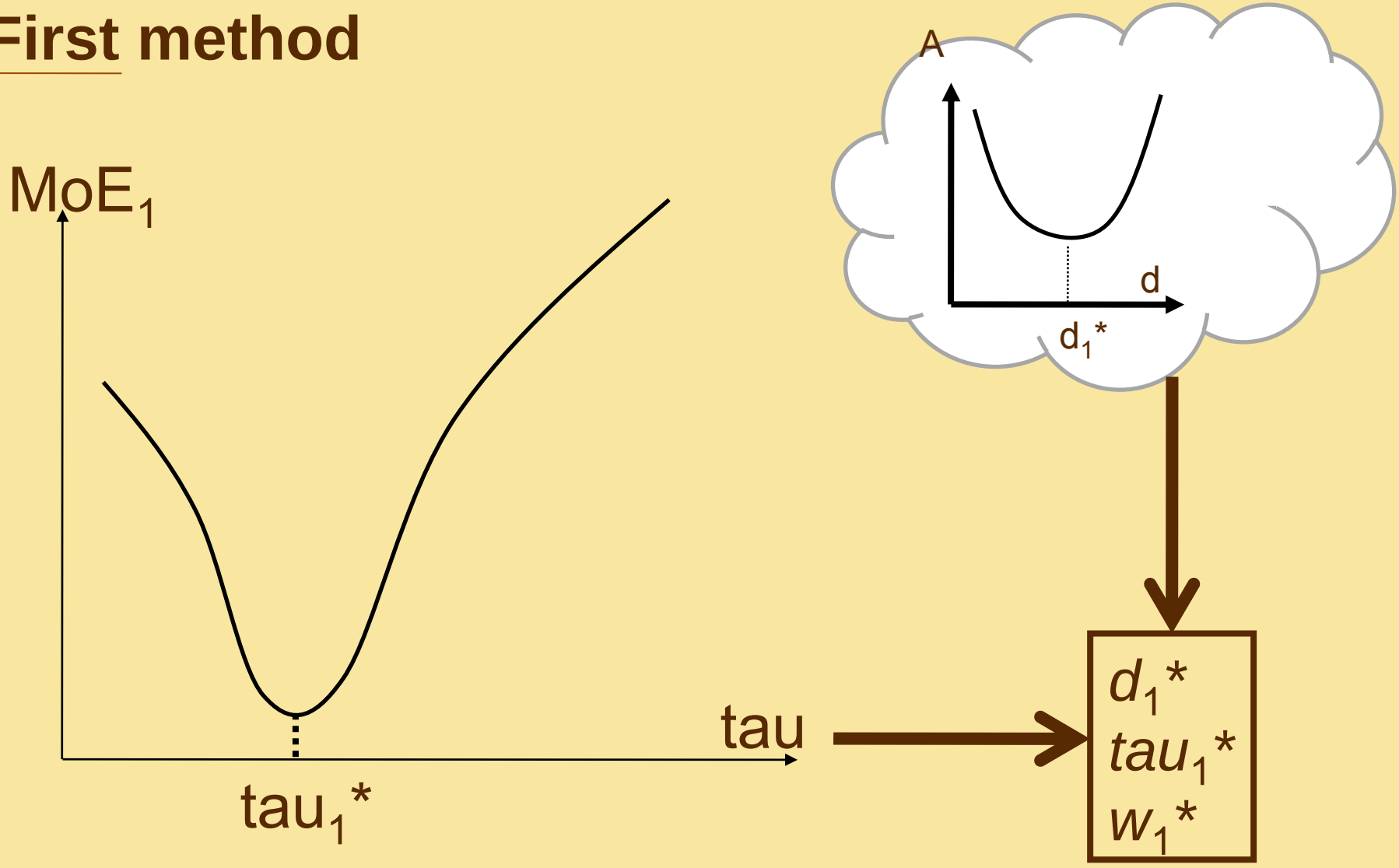
First method



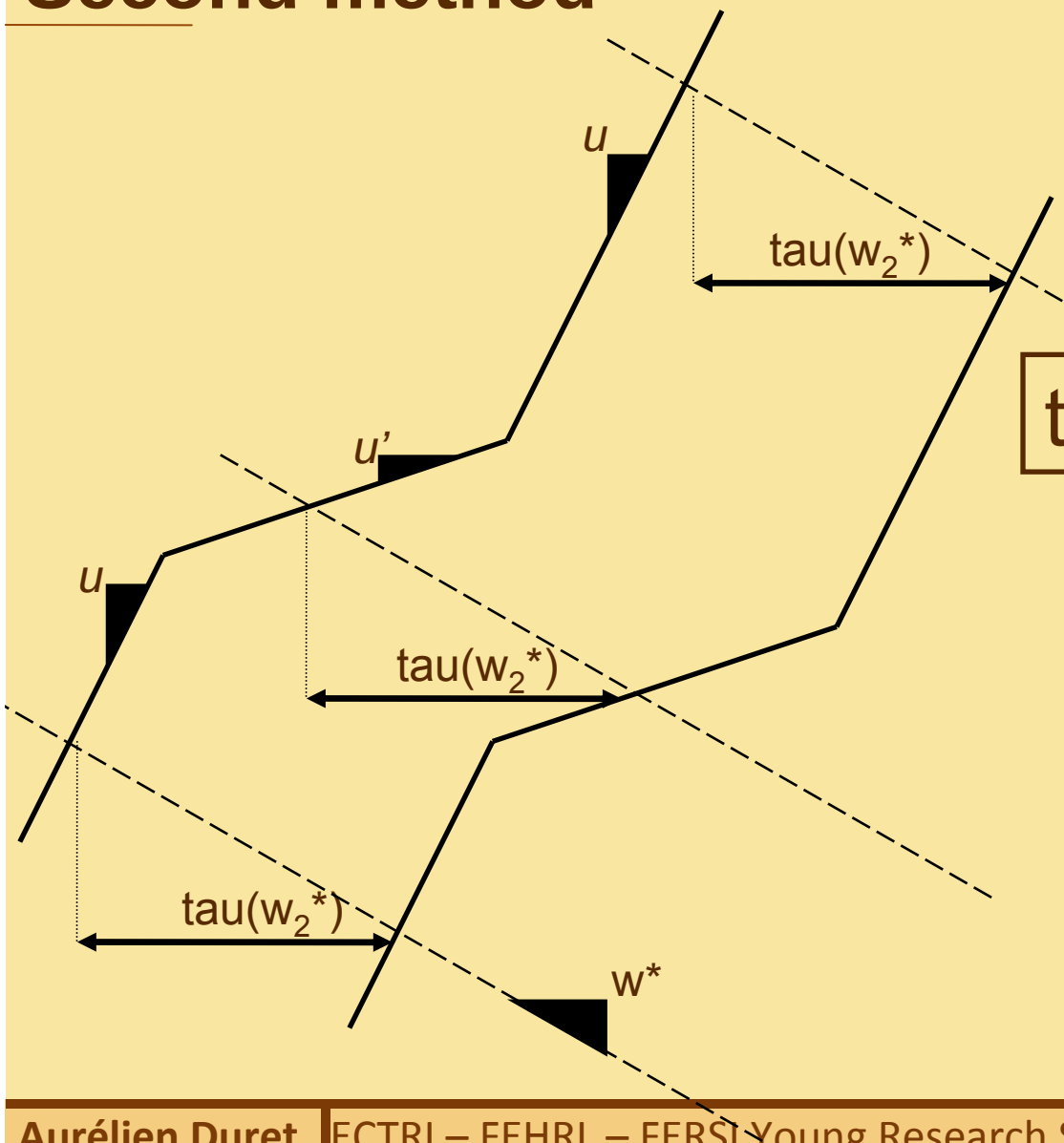
First method



First method



Second method

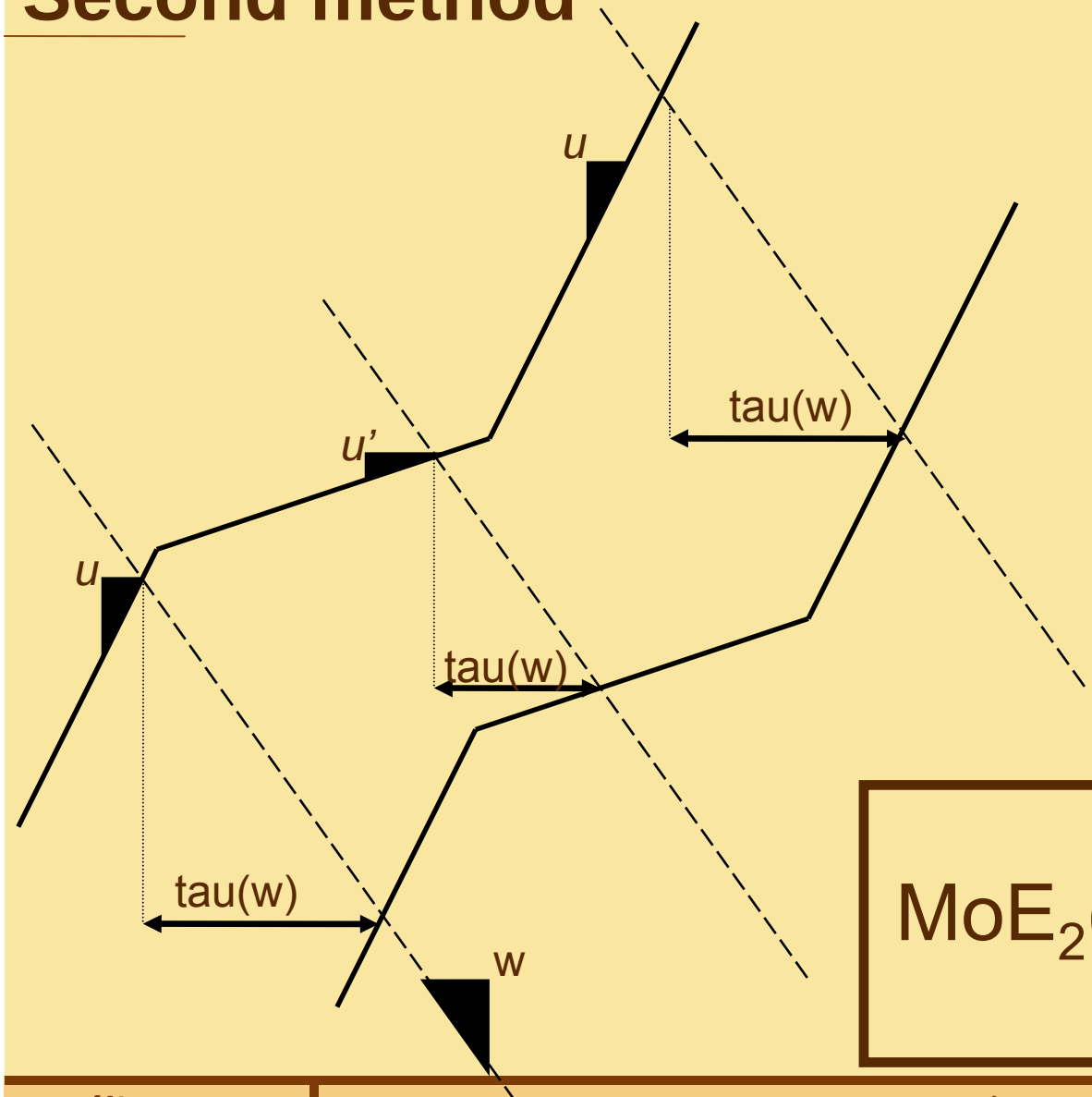


$tau(w_2^*)$=constant

→ std(tau)=0

tau_2^*=mean($tau(w_2^*)$)

Second method

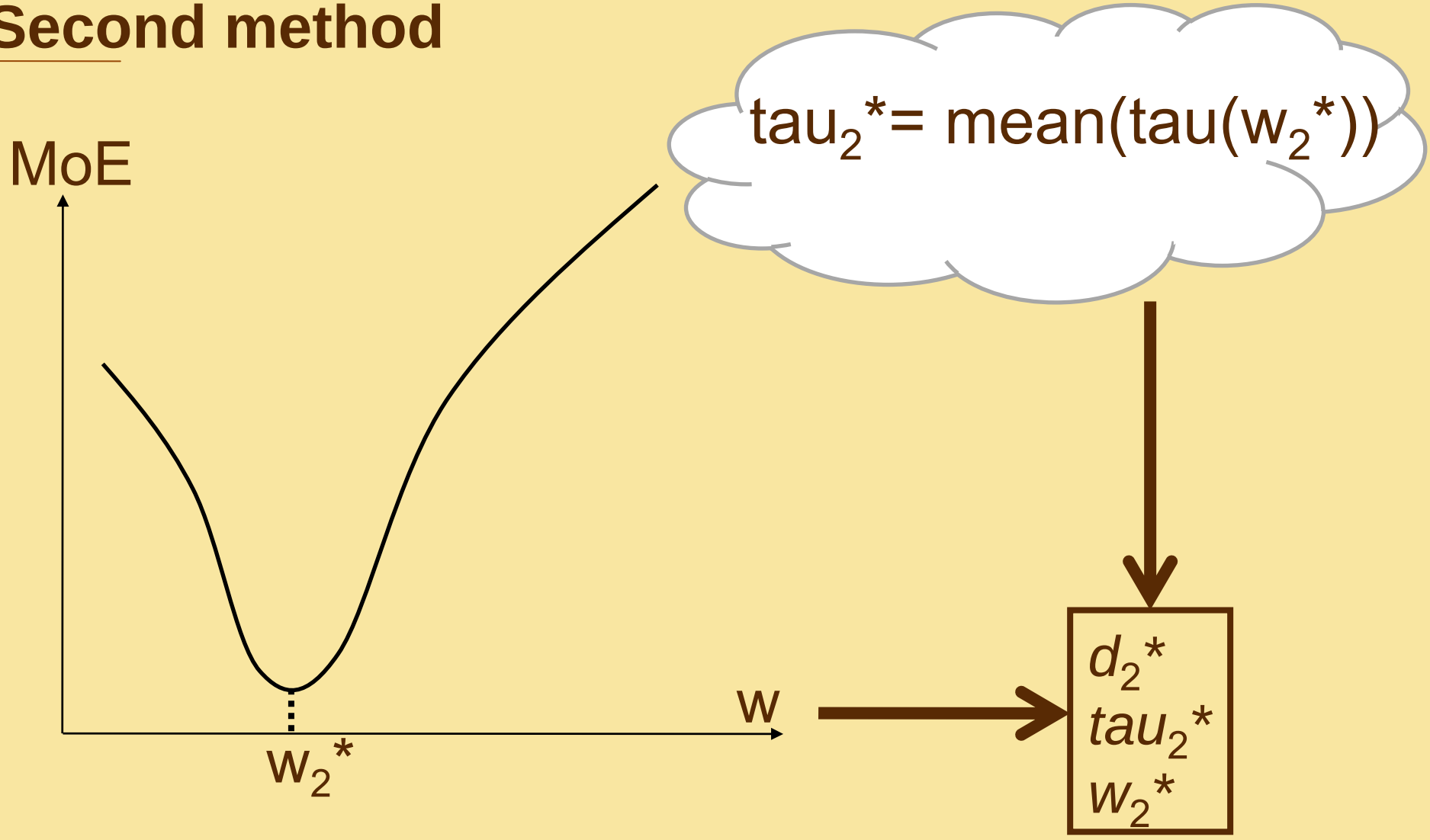


tau(w)=variable

→ std(tau)≠0

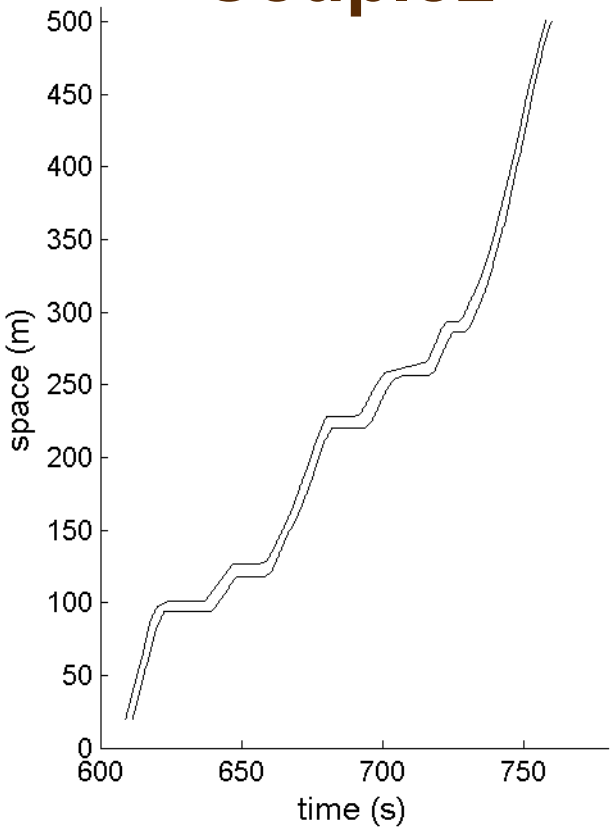
$$MoE_2(w) = \frac{std(tau(w,u))}{\overline{tau(w)}}$$

Second method



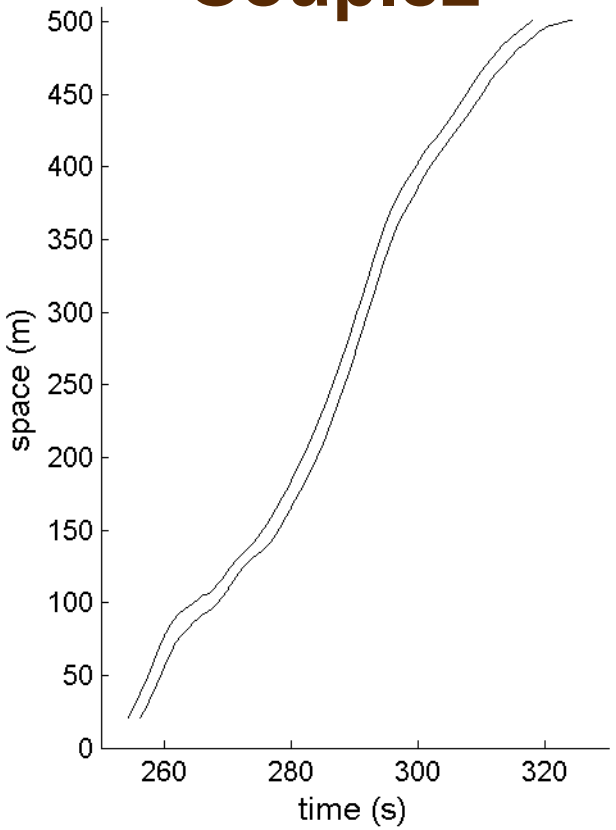
Two pairs of trajectories

Couple1



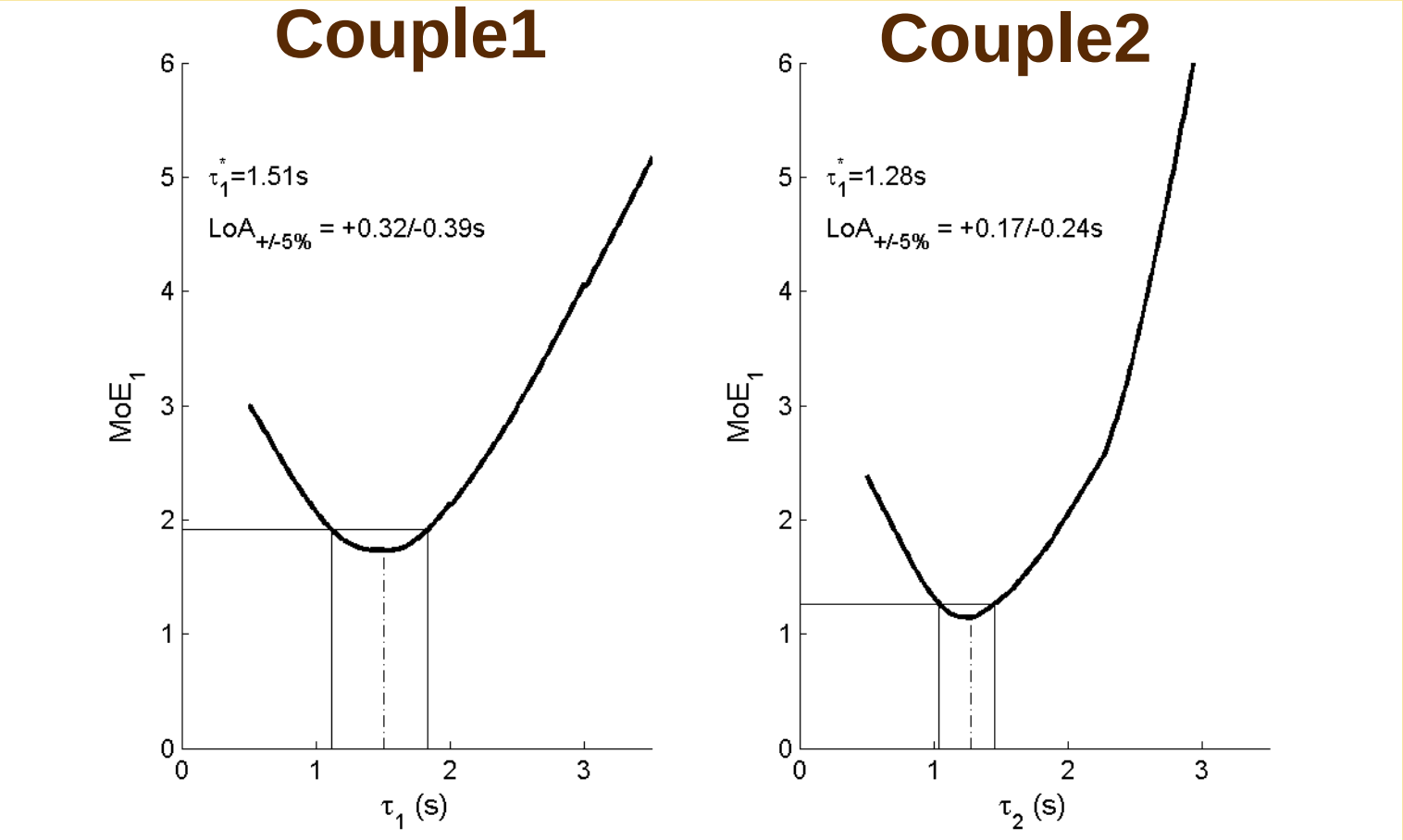
- 5 stop-&-go shockwaves
- Travel time : 150s

Couple2

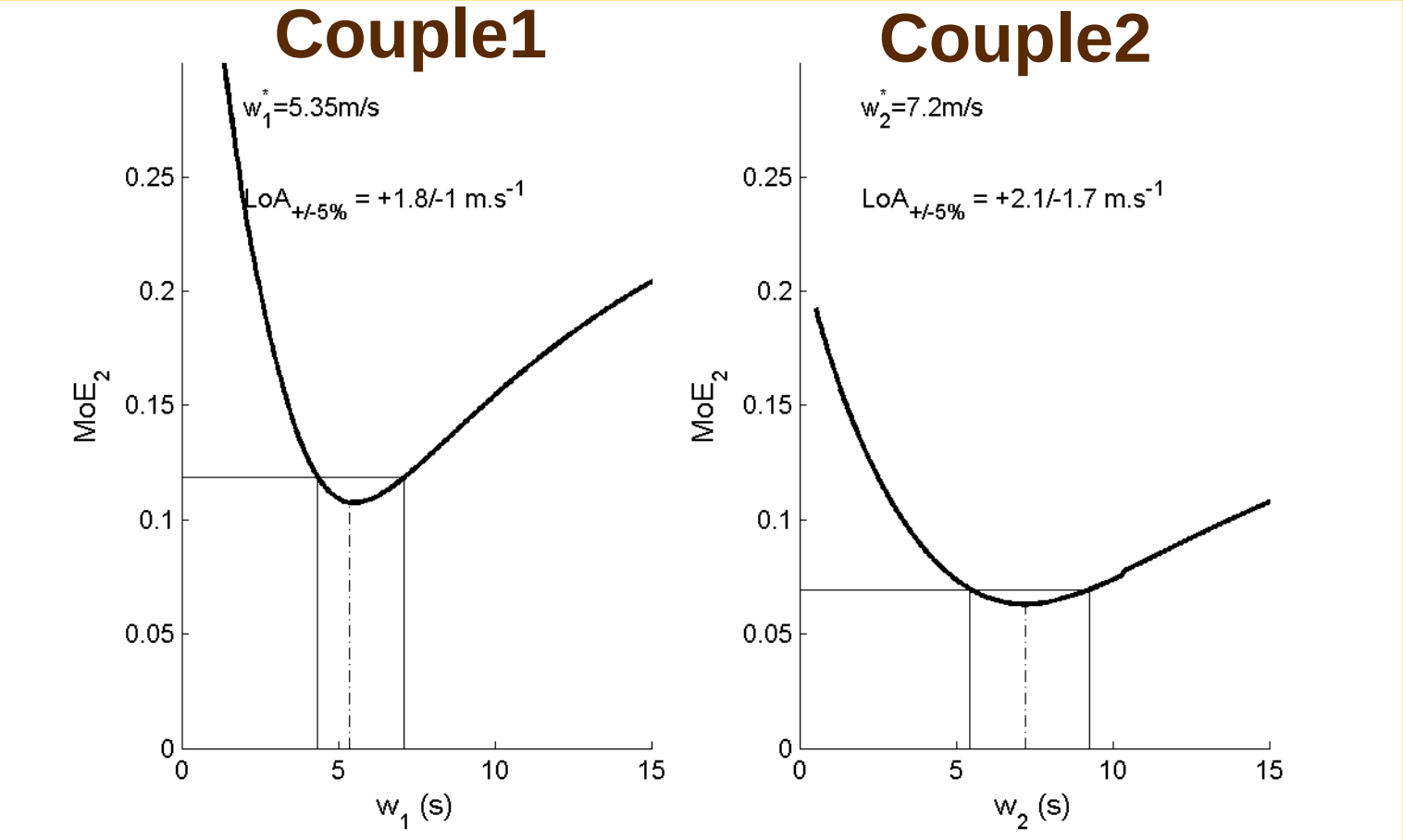


- No stop-&-go shockwave
- Travel time : 65s

MoE1


Couple1
τ_1^*=1.51s
LoA$_{+/-5\%}$ = +0.32/-0.39s
MoE$_1$
τ_1 (s)
Couple2
τ_1^*=1.28s
LoA$_{+/-5\%}$ = +0.17/-0.24s
MoE$_1$
τ_2 (s)

MoE2

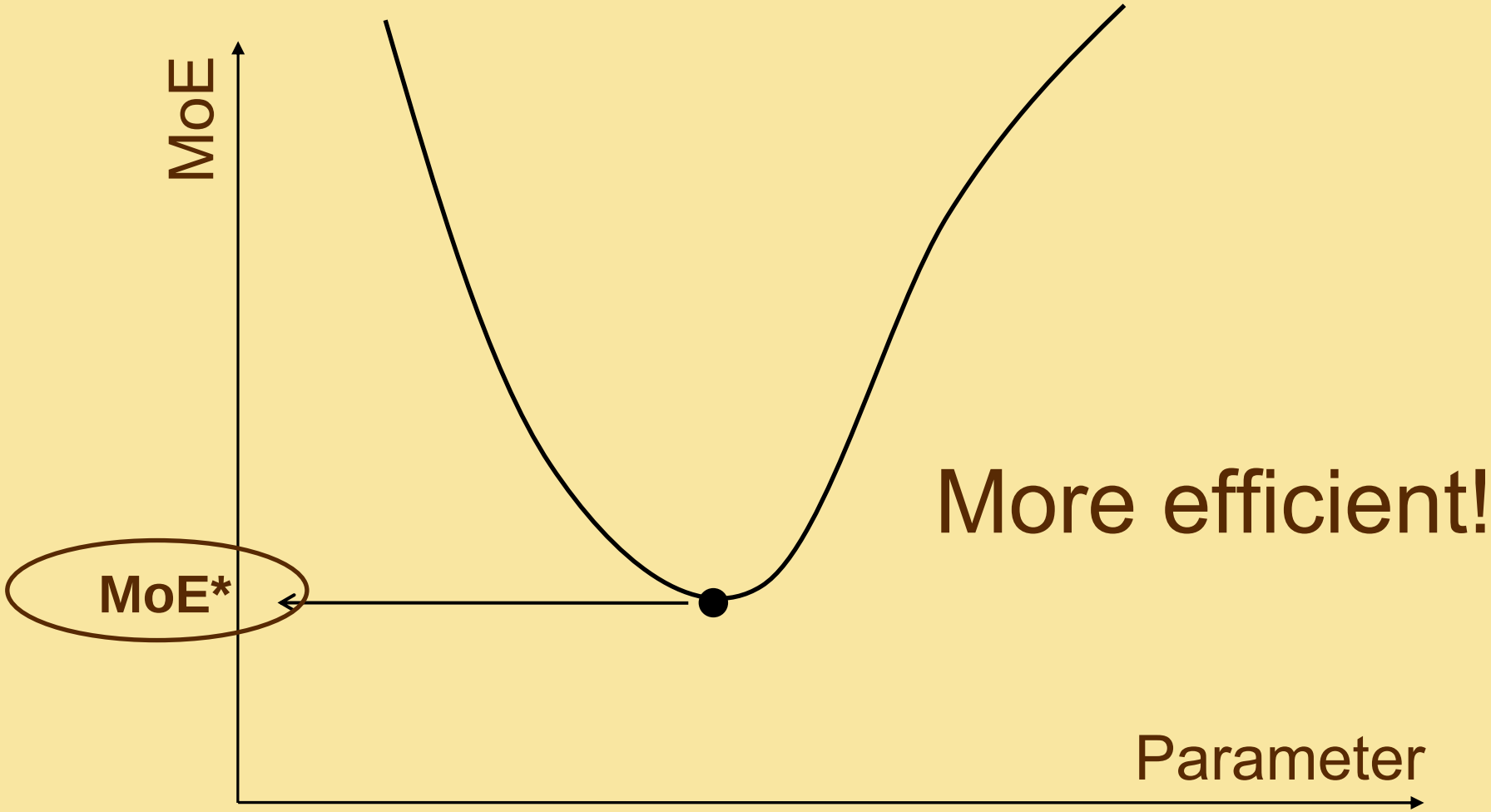

Couple1
w_1^*=5.35m/s
$LoA_{+/-5\%}$ = +1.8/-1 m.s^{-1}
MoE_2
w_1 (s)
Couple2
w_2^*=7.2m/s
$LoA_{+/-5\%}$ = +2.1/-1.7 m.s^{-1}
MoE_2
w_2 (s)

MoE1 & MoE2

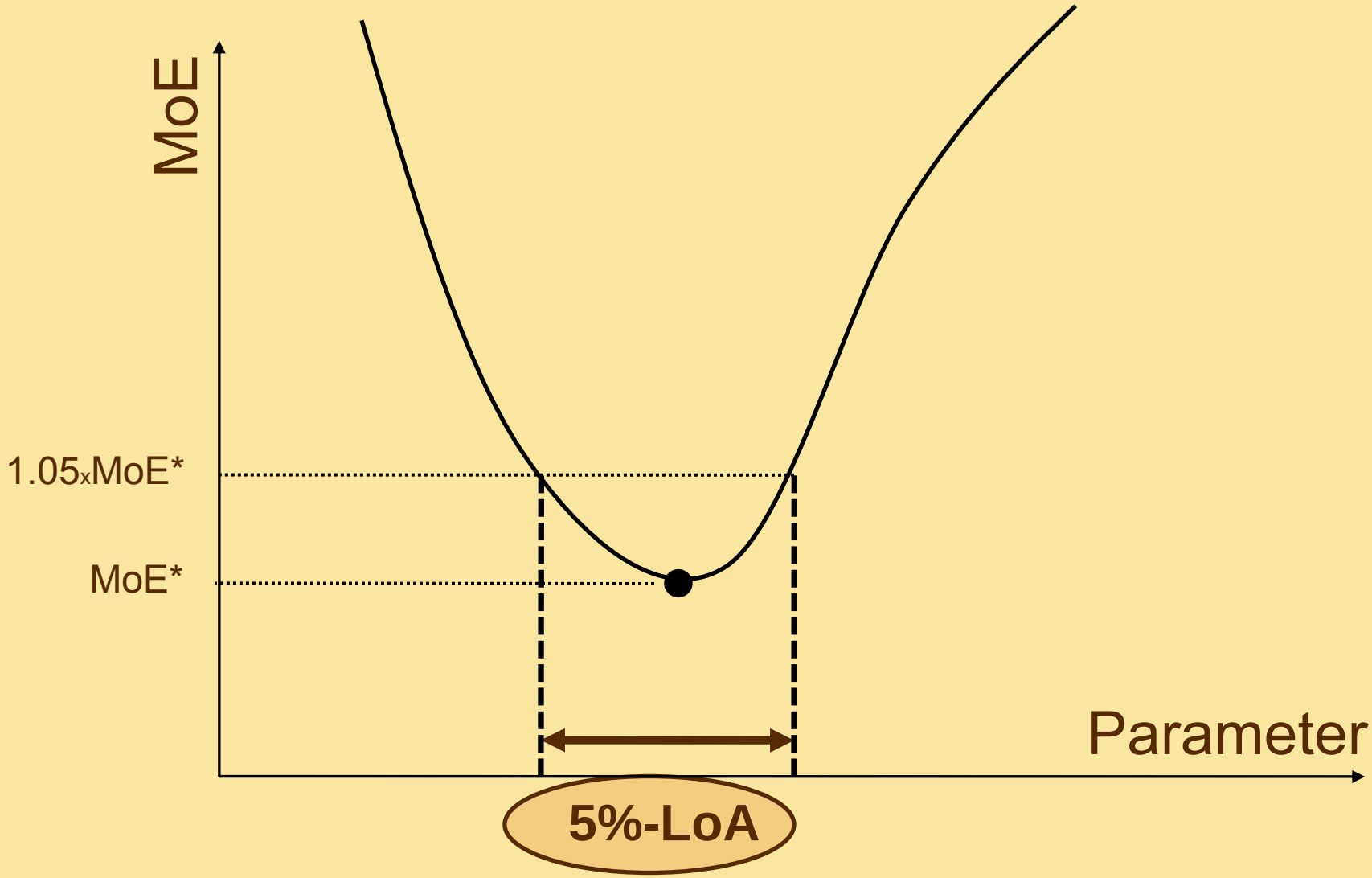
	Couple1			Couple2		
	d_1^*	tau_1^*	w_1^*	d_2^*	tau_2^*	w_2^*
First method	7.4	1.6	4.8	7.8	1.2	7.2
Second method	7.6	1.4	5.3	8.5	1.2	6.2

Efficiency? **Accuracy?**

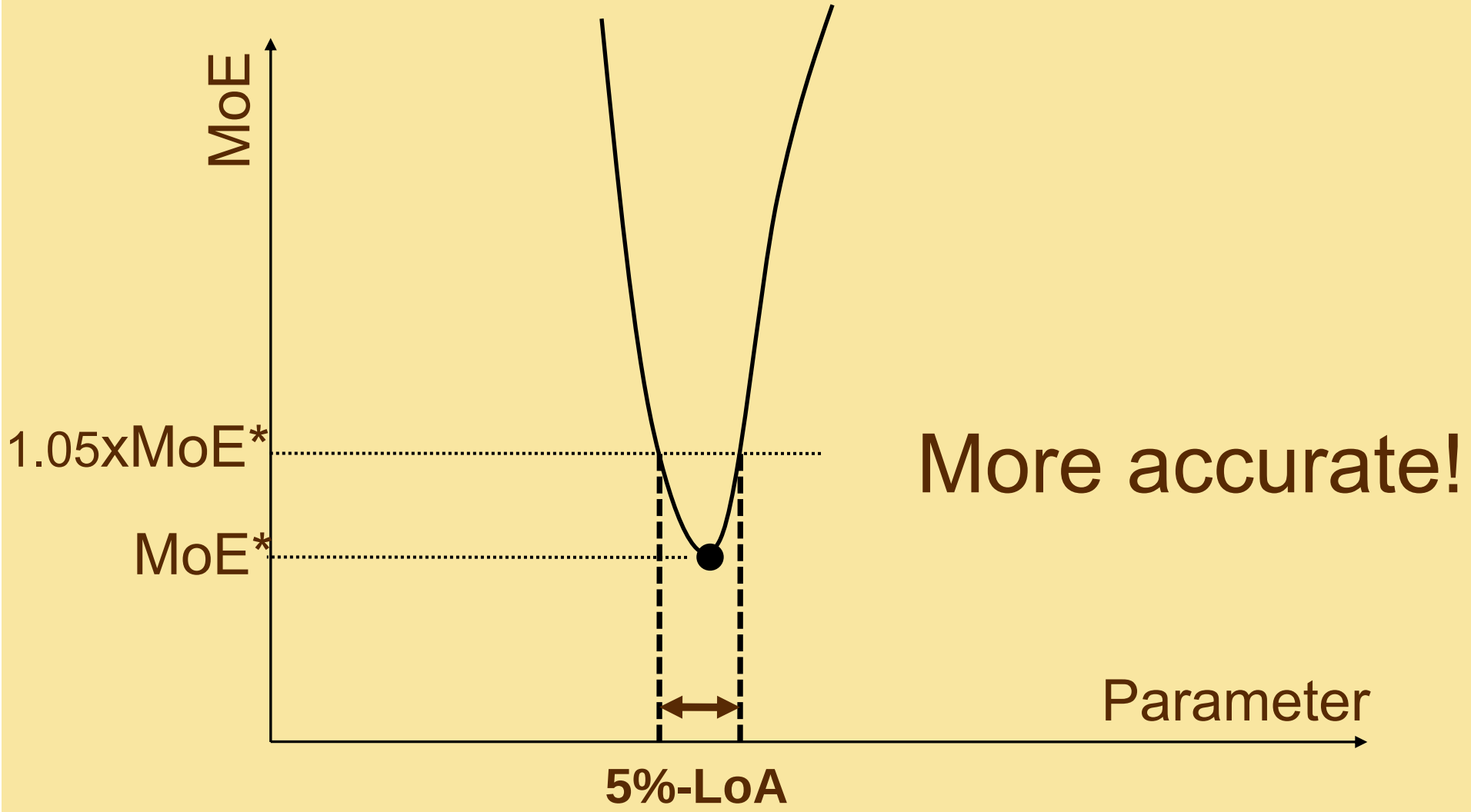
Efficiency



Accuracy



Accuracy



More accurate!

Comparison

	Couple1		Couple2	
	MoE*	**LoA_1 (Interval width)**	**MoE***	**LoA_1 (Interval width)**
First method	1.8m	3.4 m/s	1.2m	4.4 m/s
Second method	11%	2.8 m/s	7%	3.8 m/s

1 : the LoA has been normalized

Comparison

	Couple1		Couple2	
	MoE*	**LoA_1 (Interval width)**	MoE*	**LoA_1 (Interval width)**
First method	1.8m	**3.4 m/s**	1.2m	**4.4 m/s**
Second method	11%	**2.8 m/s**	7%	**3.8 m/s**

The second method is more accurate!

1 : the LoA has been normalized

Comparison

	Couple1		Couple2	
	MoE*	**LoA_1 (Interval width)**	MoE*	**LoA_1 (Interval width)**
First method	1.8m	**3.4 m/s**	1.2m	**4.4 m/s**
Second method	11%	**2.8 m/s**	7%	**3.8 m/s**

Both methods are more accurate for couple1

1 : the LoA has been normalized

Comparison

	Couple1		Couple2	
	MoE*	LoA_1 (Interval width)	**MoE***	LoA_1 (Interval width)
First method	**1.8m**	3.4 m/s	**1.2m**	4.4 m/s
Second method	**11%**	2.8 m/s	**7%**	3.8 m/s

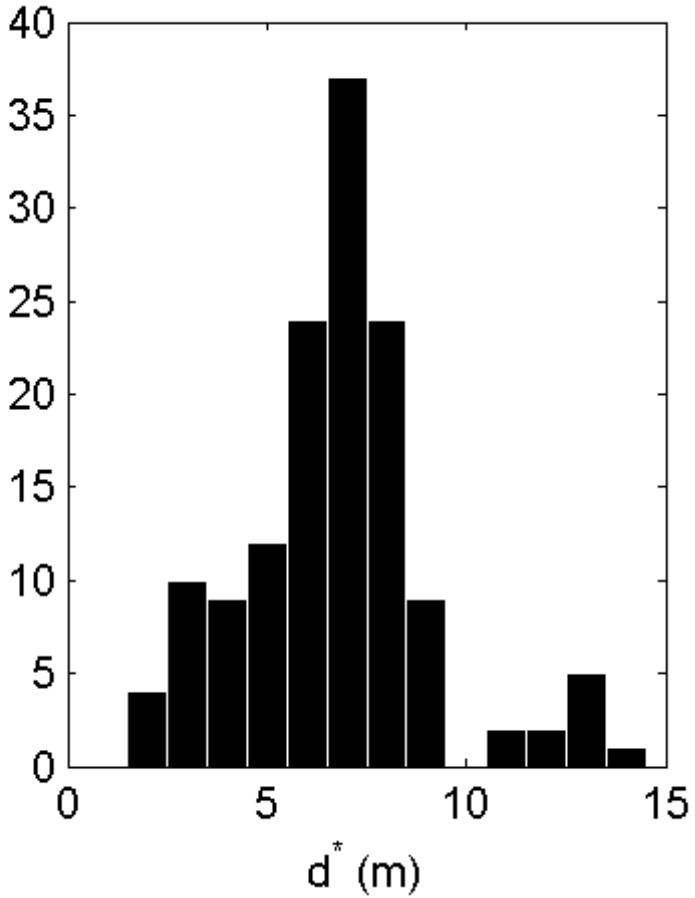
Both methods are more efficient for couple2

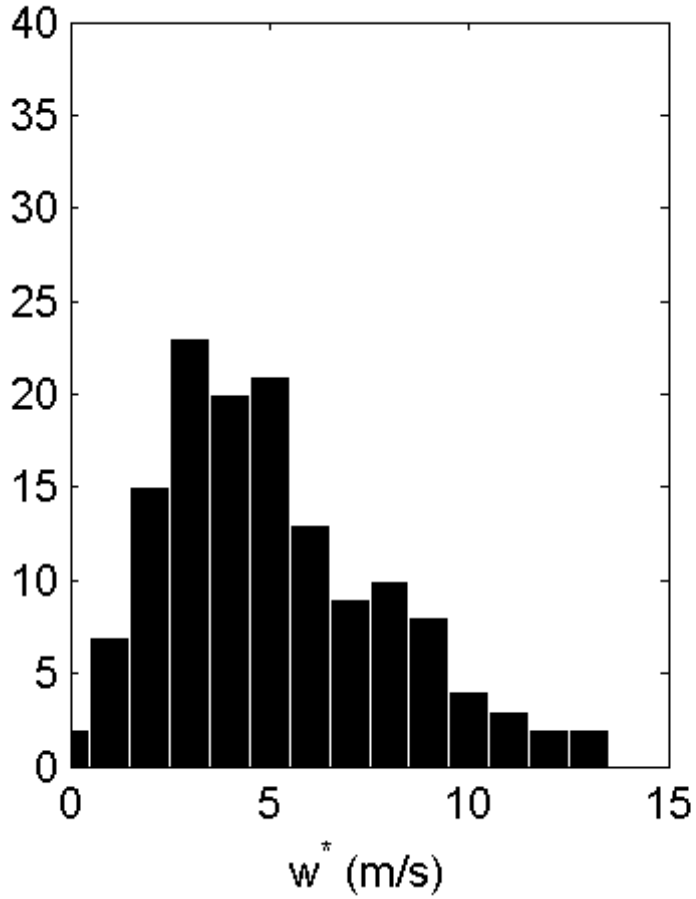
1 : the LoA has been normalized

Conclusion

- Identify a simple CF-model consistent with observations
- Explore two methods for estimating individual parameters
- Compare of the results in terms of efficiency and accuracy

Distribution





(method2)

Thank you!!!

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