

# PhD meeting

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# Outline

- ① Done
- ② Solution of anticipated event and approach to delayed event
- ③ Summer schools and workshops
- ④ Further work

# Outline

- 1 Done
- 2 Solution of anticipated event and approach to delayed event
- 3 Summer schools and workshops
- 4 Further work

# Anticipation of an event

- Solved the problem of an anticipated event (90 %)
- Worked on Introduction to Convex Optimization exam
- Studied Roy's course to give the exam this week

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## Method to solve anticipated event

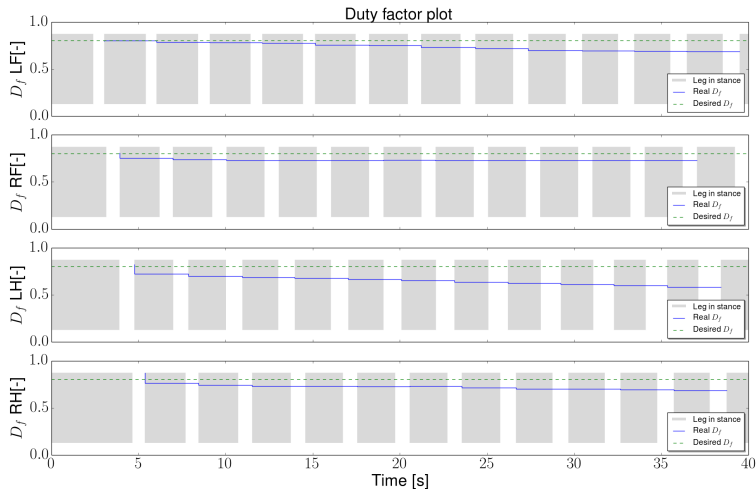
- Detect when a touchdown or lift-off occurs (just related to reference for now)
- Update list of current events [Shahbazi 2015]
- Compute next list events according to new state of current events

$k$	$g_1(k)$	$g_2(k)$	$g_3(k)$	$g_4(k)$	$l_1(k)$	$l_2(k)$	$l_3(k)$	$l_4(k)$
0	0	0	0	0	0	0	0	0
1	2.4 (2.3)	3.6	3.6	2.4,	1.4	2.6	2.6	1.4
2	4.8	6	6	4.8	3.8	5	5	3.8
3	7.2	8.4	8.4	7.2	6.2	7.4	7.4	6.2
4	9.6	10.8	10.8	9.6	8.6	9.8	9.8	8.6
5	12	13.2	13.2	12	11	12.2	12.2	11

# Simulation parameters

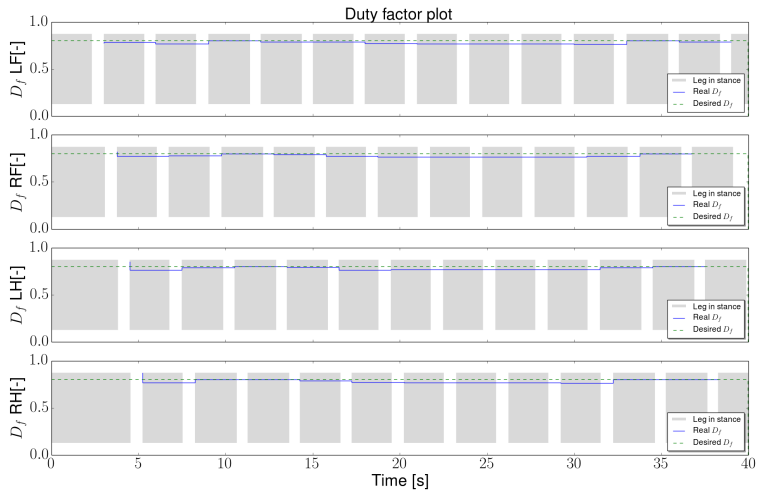
- Simulated a slower convergence in the oscillator equations (i.e., lowered the gains  $\alpha = 0.05$  and  $\beta = 0.05$ )
- Gait parameters:
  - $G = 1 \prec 2 \prec 3 \prec 4$
  - $D_f = 0.8$
  - $S_f = 1/3 \frac{1}{s}$
  - $\Delta = [0.15, 0.15, 0.15, 0.15]$

# Duty factor without feedback

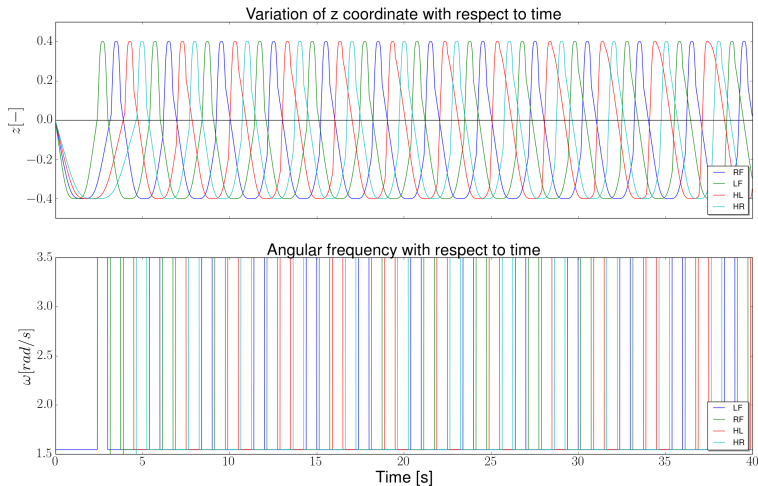




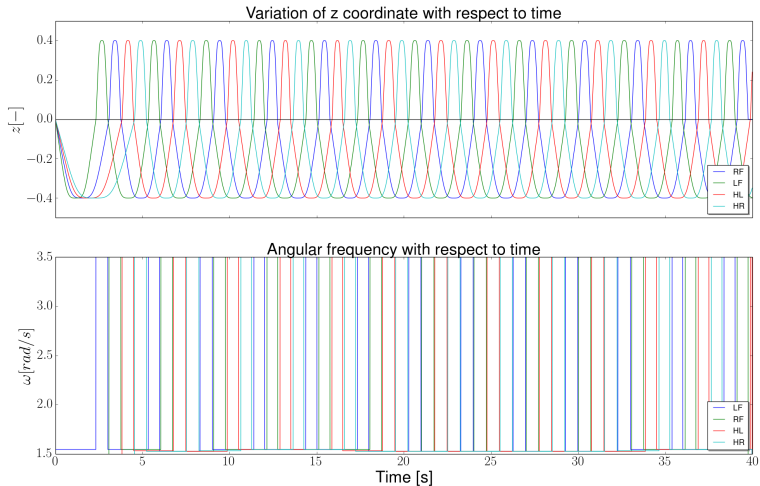
# Duty factor with feedback



# Position and angular frequency of the legs without feedback



# Position and angular frequency of the legs with feedback



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- Numerical methods for optimal control problems (NUMOC) (Rome, Italy, June 19th-23rd)
- Machine Learning Crash Course (Genova, Italy, June 26th-30th)
- BMVA Computer Vision Summer School (Lincoln, UK, July 3rd-7th)

## Approach delayed event

- Predict the new time of the delayed event based on sensor information and model [Shahbazi 2016]
- Use Model Predictive Control approach to ensure that the legs fulfill an specified schedule (not sure if this is the right way, main problem: disturbance model) [De Schutter 2001]
- On-off approach: wait until the leg reaches an event and update list of events

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## Further work

- Use the proposed strategy in the current framework
- Consider a delay in the occurrence of an event (prediction)
- Give Roy's exam (this week)



Thank you. Questions or comments?