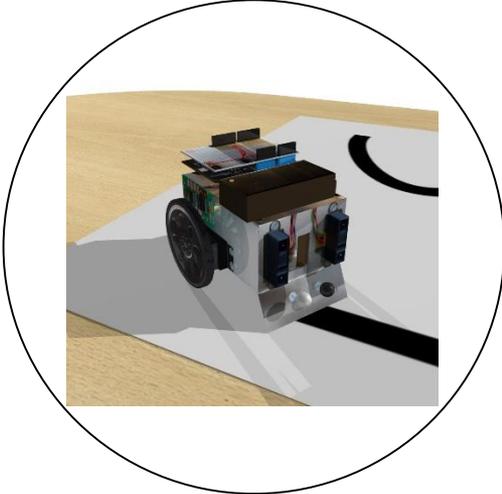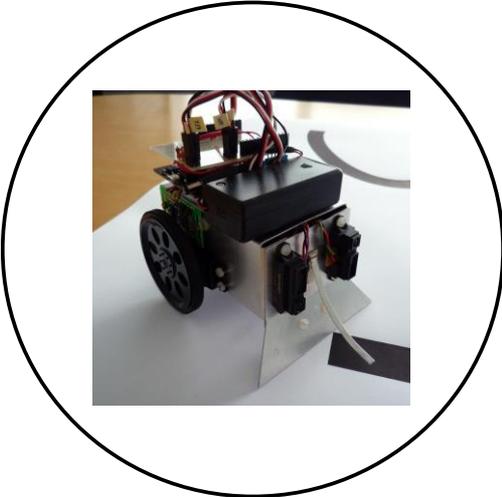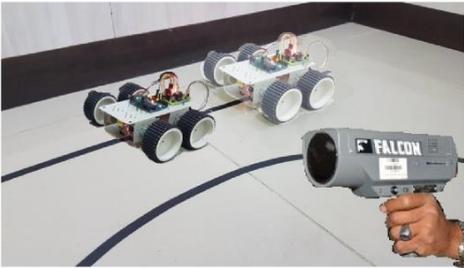# Co-simulation

Cláudio Gomes
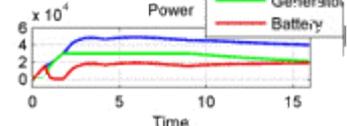
Simulation

Experimentation

Simulation

Simulation is useful

https://www.slashgear.com/virtual-simulation-and-robotic-butt-named-patrick-offers-med-students-hands-on-practice-13305334/

Co-Simulation


```
for i in people.data.users:
    response = client.api.statuses.user_timeline.get(screen_name=i.scre
    print 'Got', len(response.data), 'tweets from', i.screen_name
    if len(response.data) != 0:
        ltdate = response.data[0]['created_at']
        ltdate2 = datetime.strptime(ltdate,'%a %b %d %H:%M:%S +0000 %Y'
        today = datetime.now()
        howlong = (today-ltdate2).days
        if howlong < daywindow:
            print i.screen_name, 'has tweeted in the past' , daywindow,
            totaltweets += len(response.data)
            for j in response.data:
                if j.entities.urls:
                    for k in j.entities.urls:
                        newurl = k['expanded_url']
                        urlset.add((newurl, j.user.screen_name))
        else:
            print i.screen_name, 'has not tweeted in the past', daywind
```
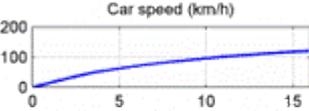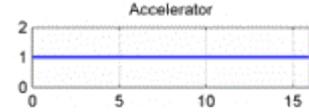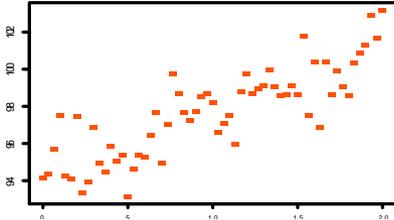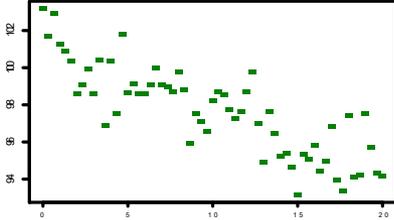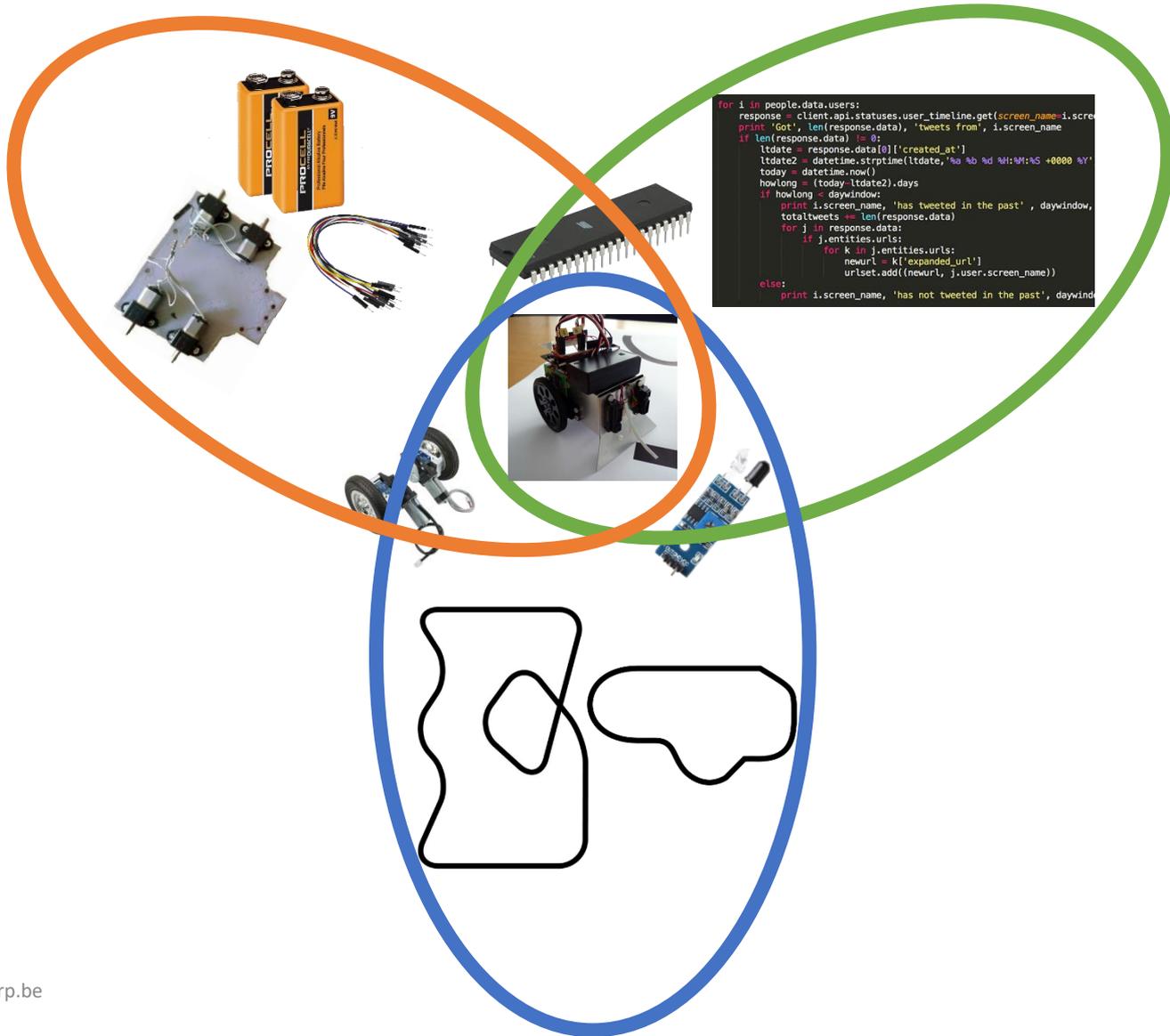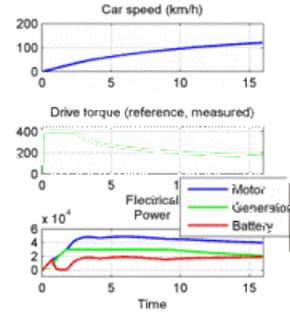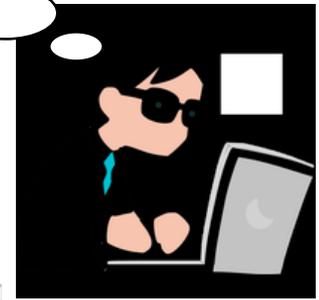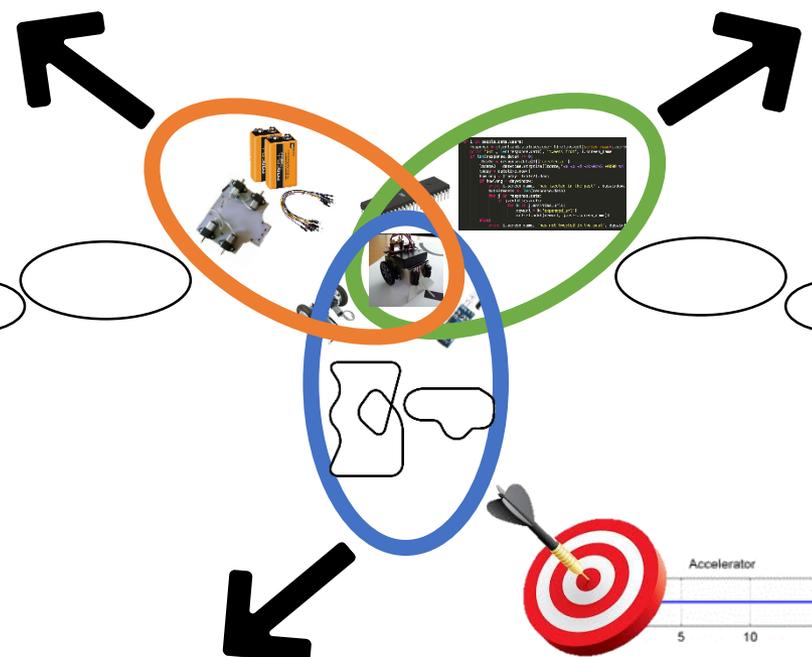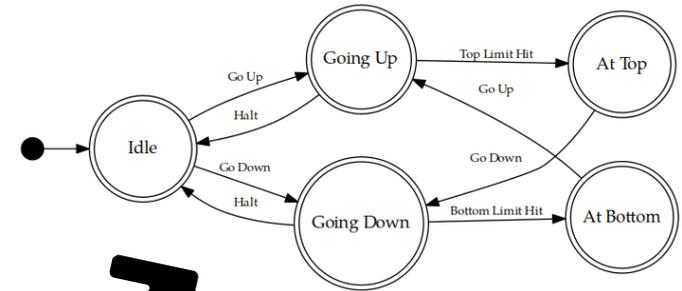
Co-Simulation

$$Y(t) = A(t)\,K(t)^{\frac{1}{3}}\,Ly(t)^{\frac{2}{3}}$$

$$\frac{d}{dt}K(t) = s\,Y(t) - d\,K(t)$$

$$\frac{d}{dt}A(t) = z\,A(t)\,La(t)$$

$$Ly(t) + La(t) = L$$

$$La(t) = l\,L$$
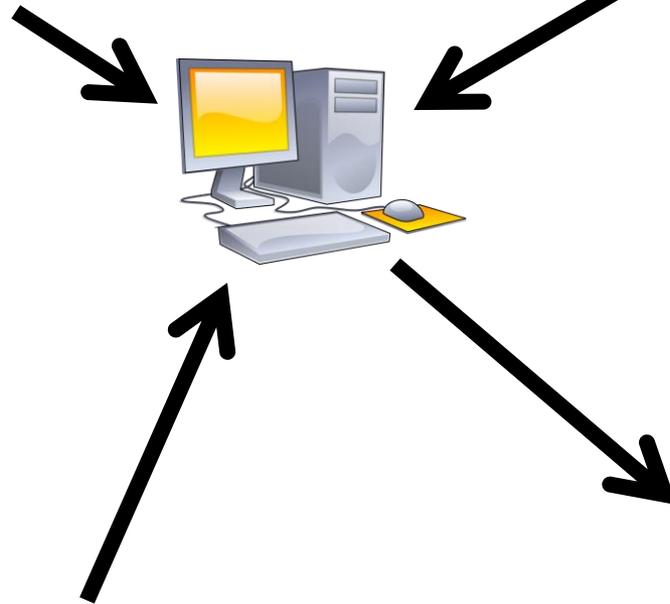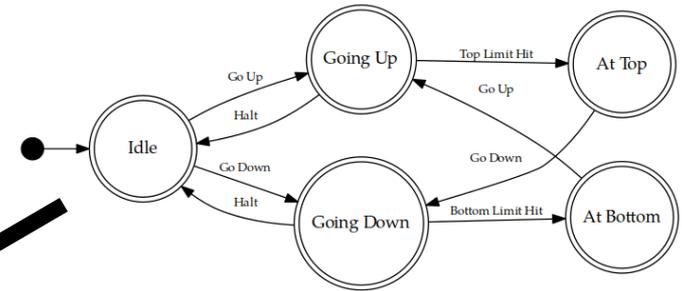

5

Co-Simulation

$$Y(t) = A(t) \ K(t)^{\frac{1}{3}} \ Ly(t)^{\frac{2}{3}}$$

$$\frac{d}{dt} K(t) = s \, Y(t) - d \, K(t)$$

$$\frac{d}{dt} A(t) = z \, A(t) \, La(t)$$
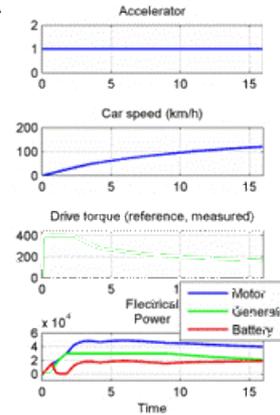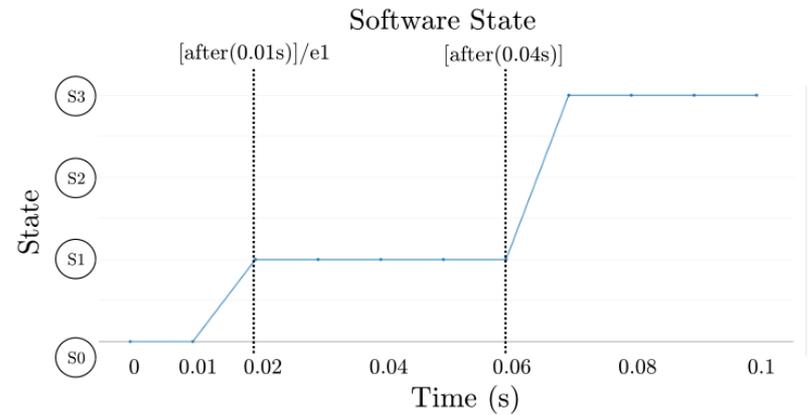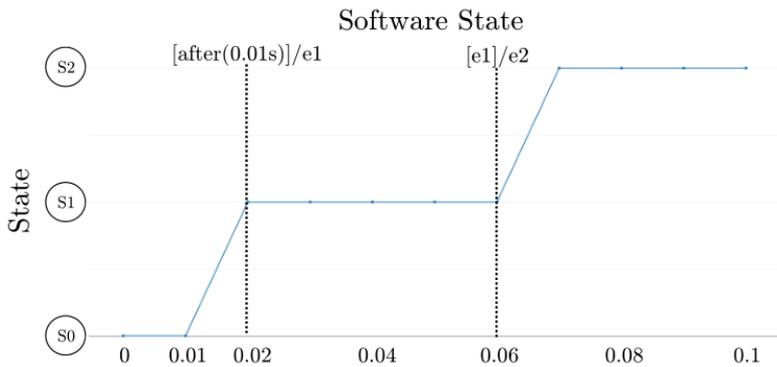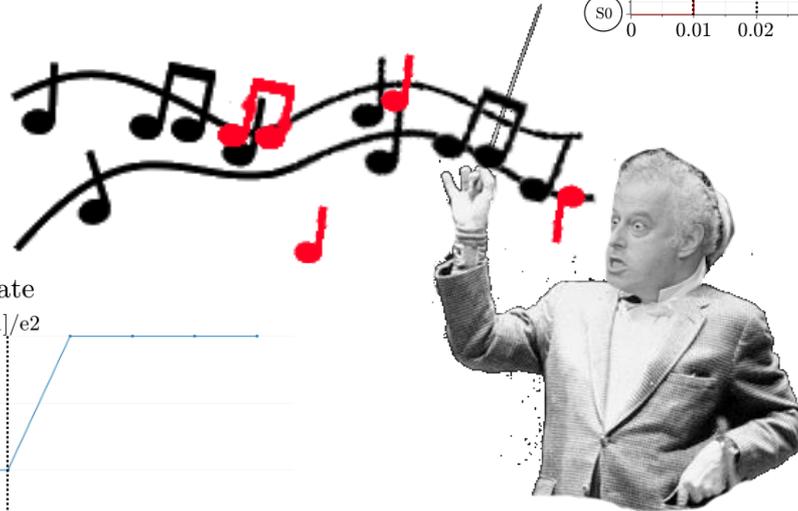
$$Ly(t) + La(t) = L$$

$$La(t) = l \, L$$

Co-Simulation

$$Y(t) = A(t) \, K(t)^{\frac{1}{3}} \, Ly(t)^{\frac{2}{3}}$$

$$\frac{d}{dt} K(t) \qquad d\, K(t)$$

$$\frac{d}{dt} A(t)$$

$$Ly(t) + L$$

Challenge

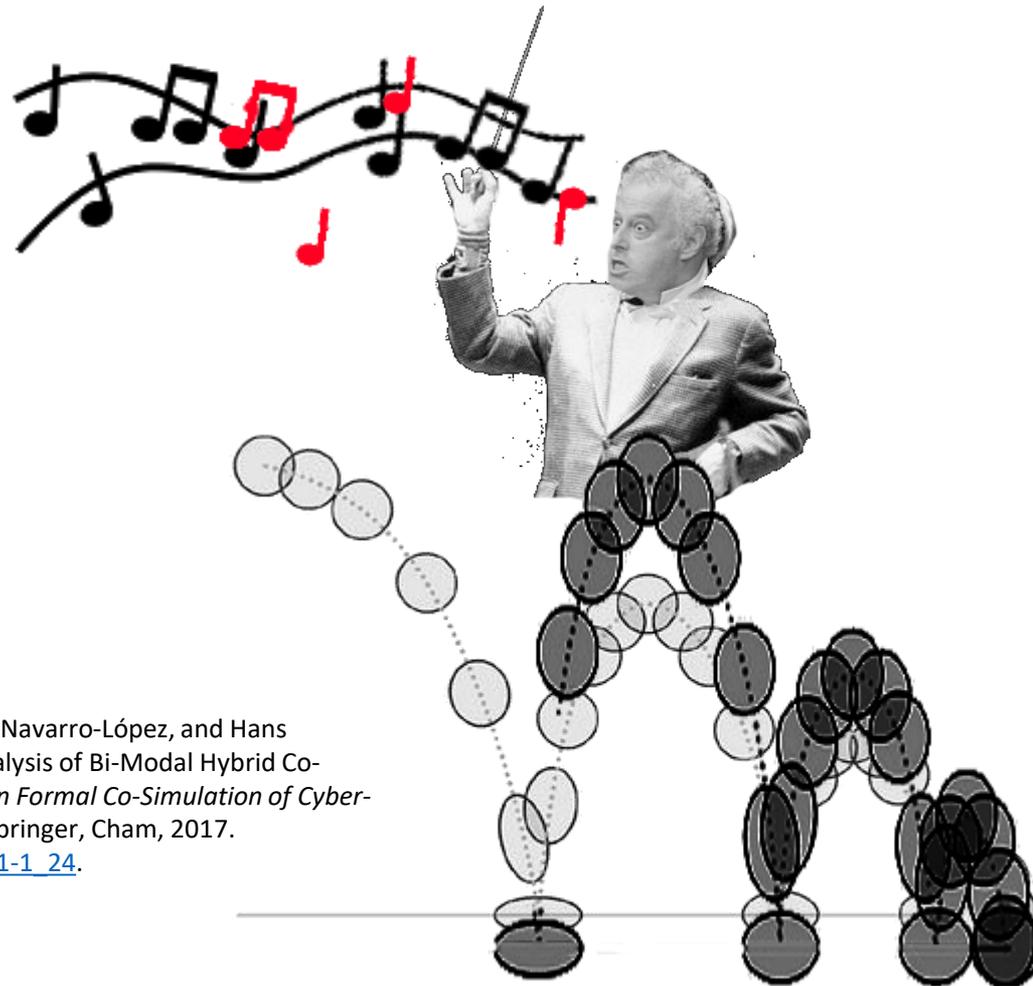Thule, Casper, Cláudio Gomes, Julien Deantoni, Peter Gorm Larsen, Jörg Brauer, and Hans Vangheluwe. "Towards Verification of Hybrid Co-Simulation Algorithms." In *2nd Workshop on Formal Co-Simulation of Cyber-Physical Systems*, to be published. Toulouse, France: Springer, Cham, 2018.

Challenge

Gomes, Cláudio, Paschalis Karalis, Eva M. Navarro-López, and Hans Vangheluwe. "Approximated Stability Analysis of Bi-Modal Hybrid Co-Simulation Scenarios." In *1st Workshop on Formal Co-Simulation of Cyber-Physical Systems*, 345–60. Trento, Italy: Springer, Cham, 2017. https://doi.org/10.1007/978-3-319-74781-1_24.

Challenge

Gomes, Cláudio, Benoît Legat, Raphaël Jungers, and Hans Vangheluwe. "Minimally Constrained Stable Switched Systems and Application to Co-Simulation." In *IEEE Conference on Decision and Control*, to be published. Miami Beach, FL, USA, 2018.
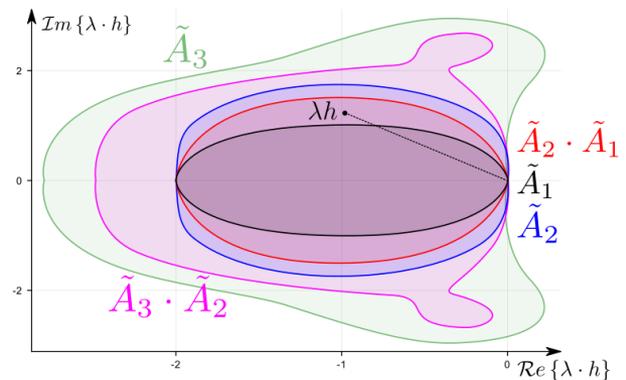
Thank you!

Questions?

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