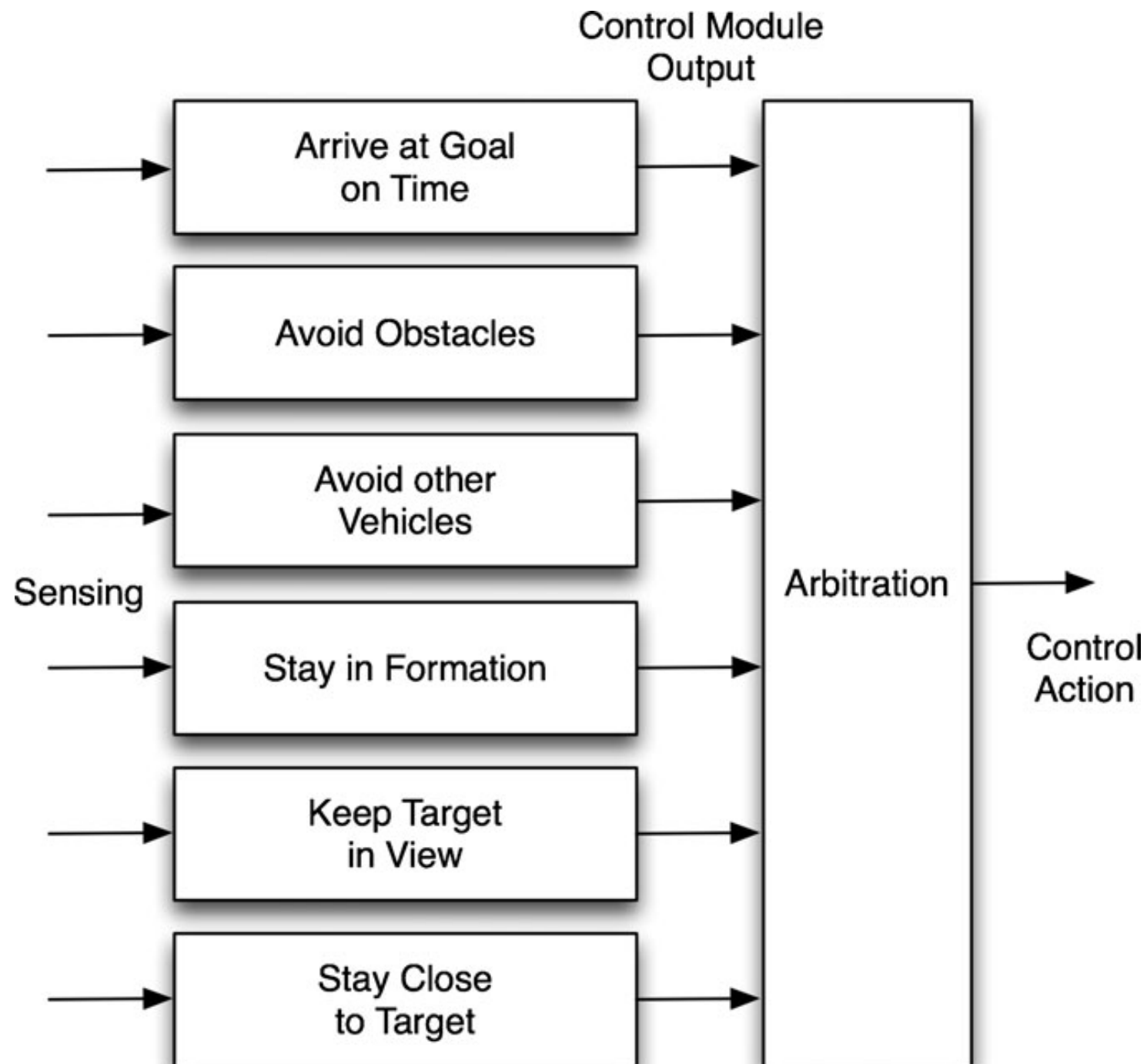# Promises of multiple objective control of robots
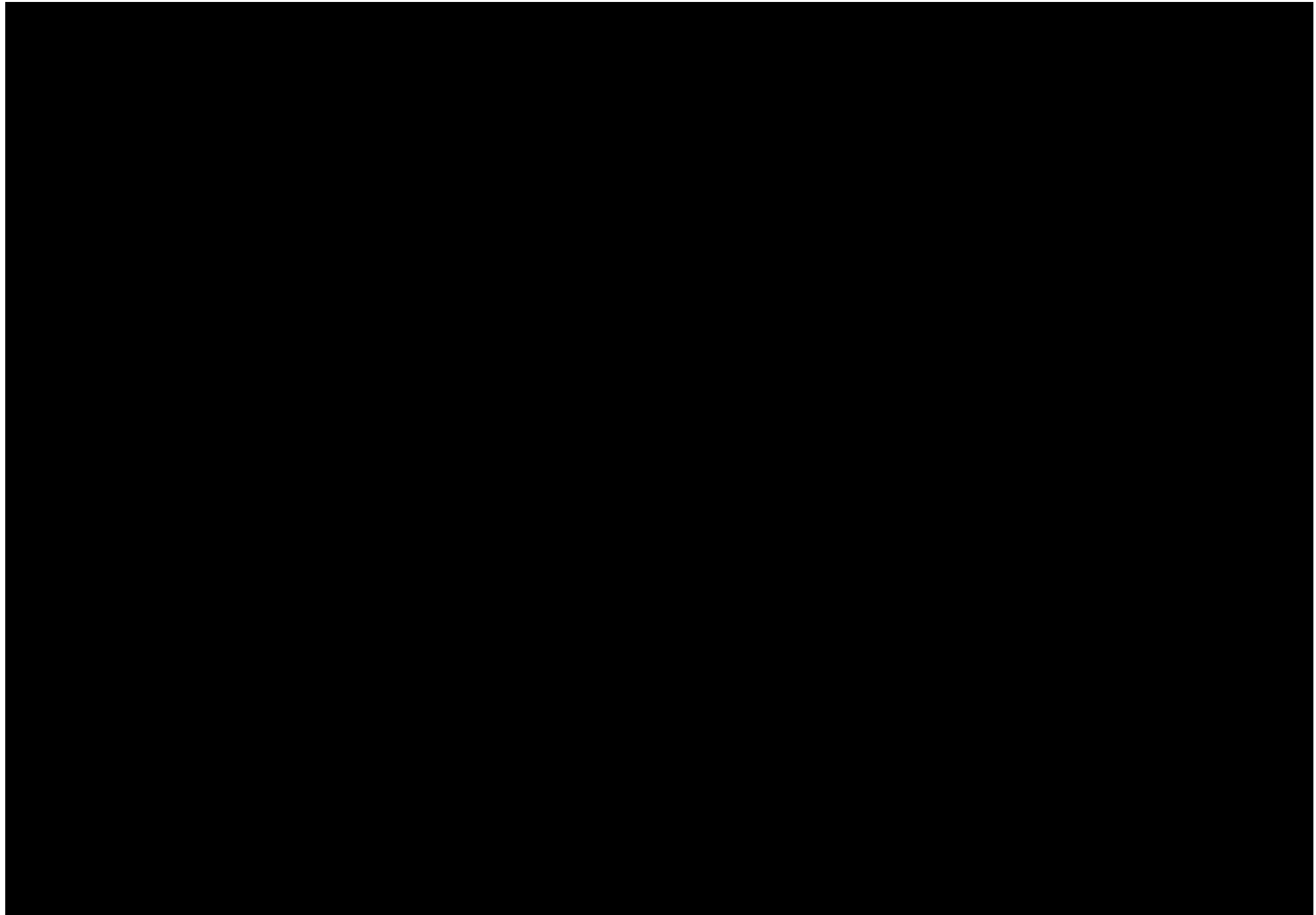
Pierre-Brice Wieber
INRIA Grenoble Rhône-Alpes

# Robots have to deal with multiple objectives
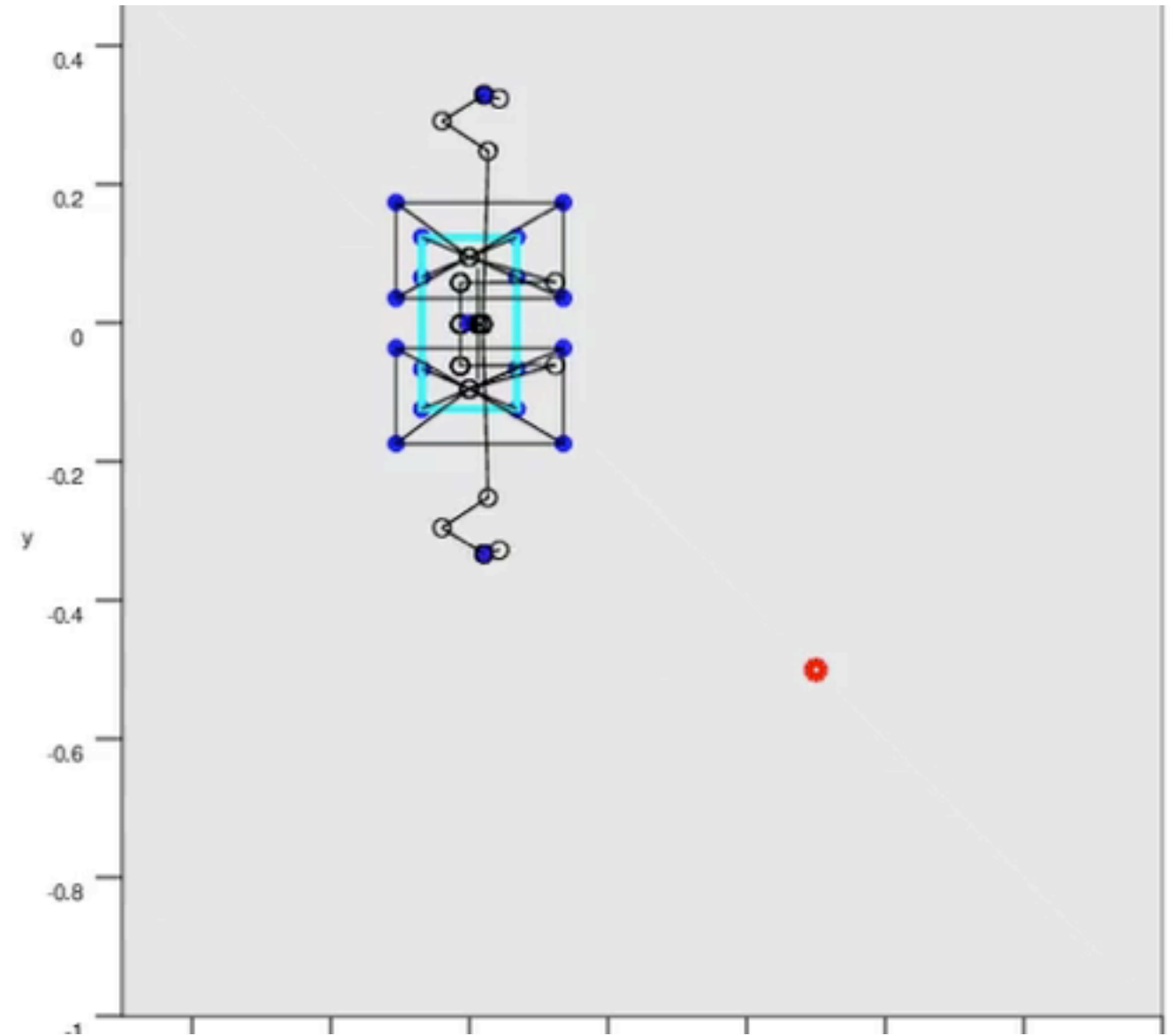
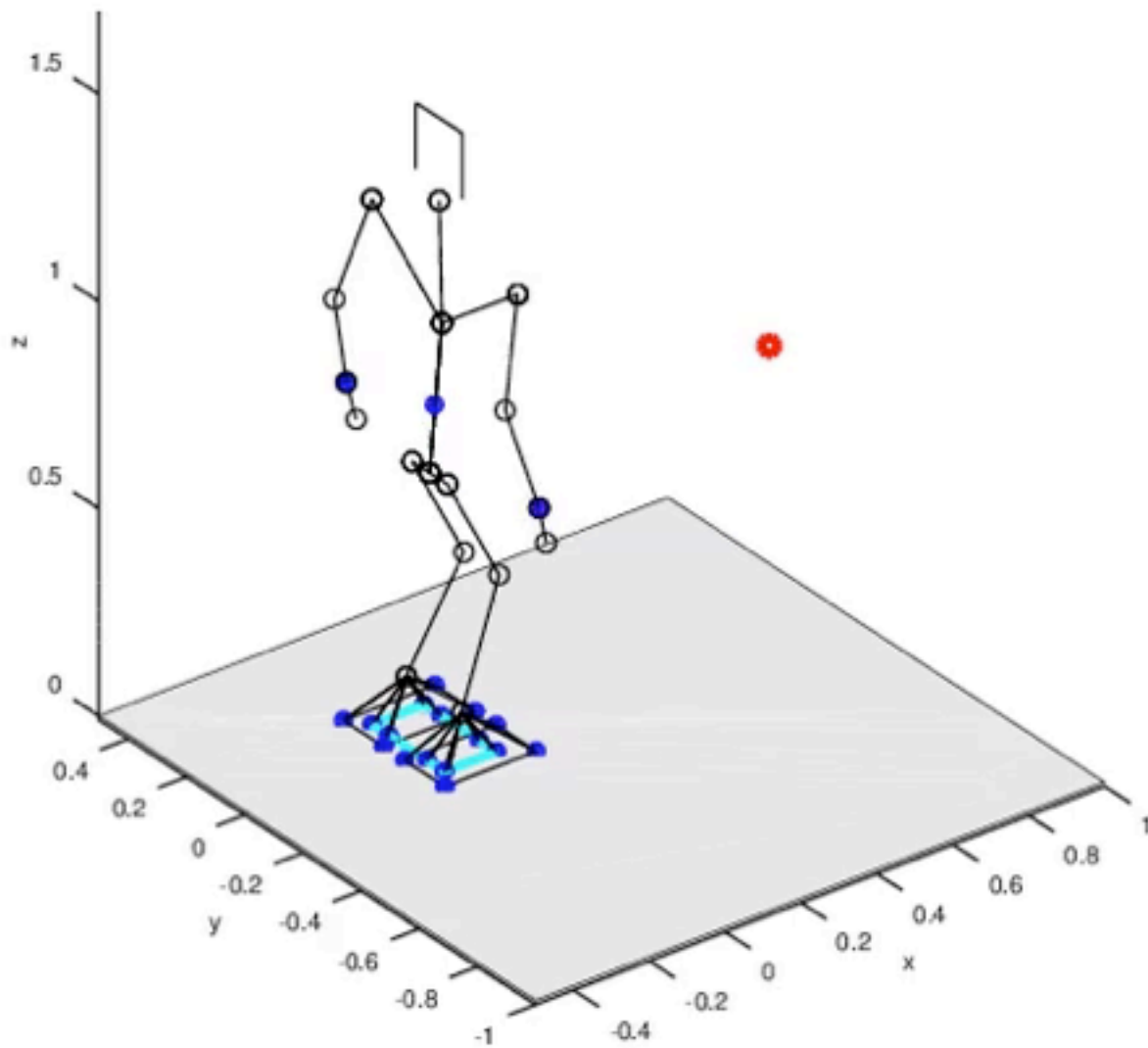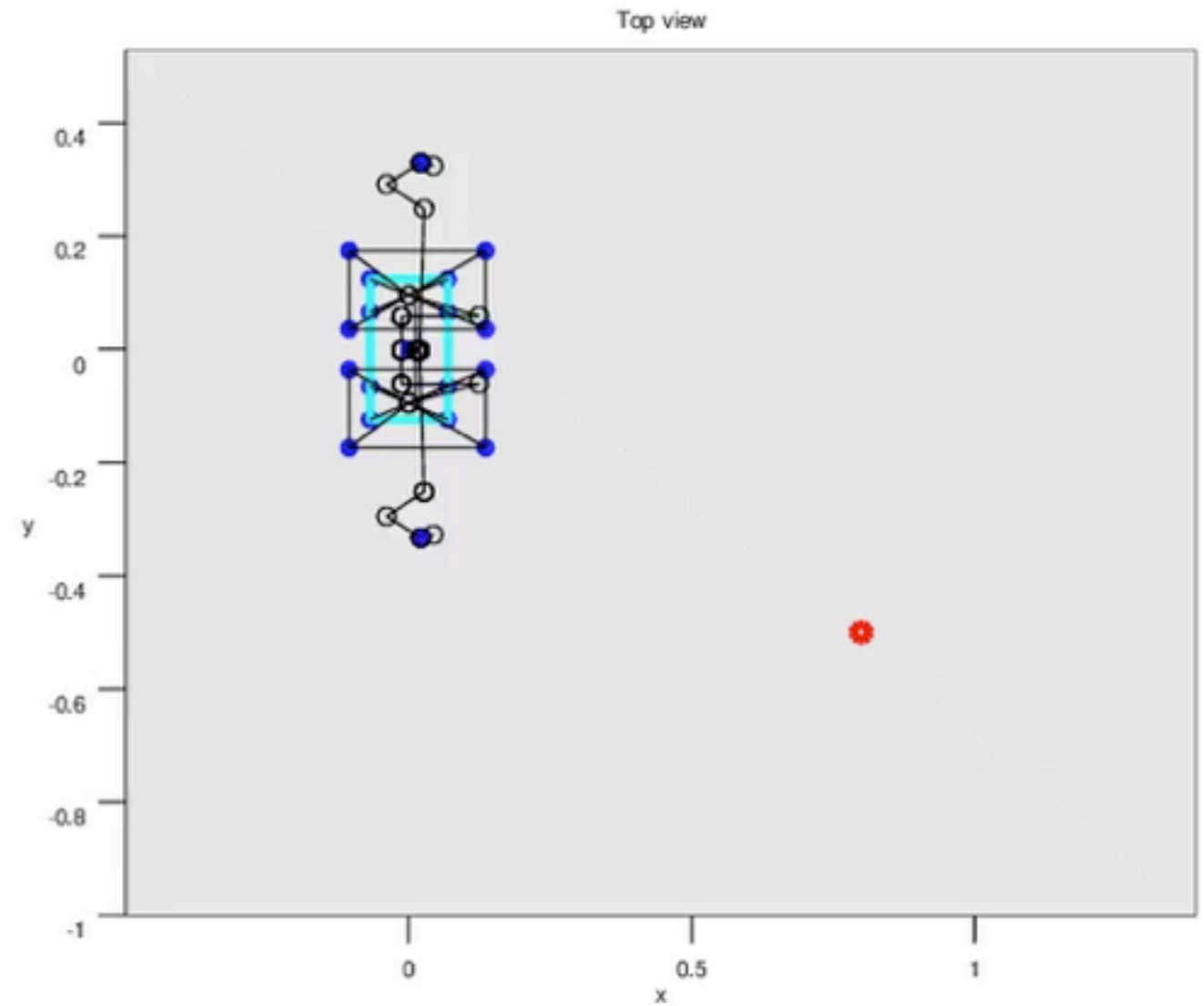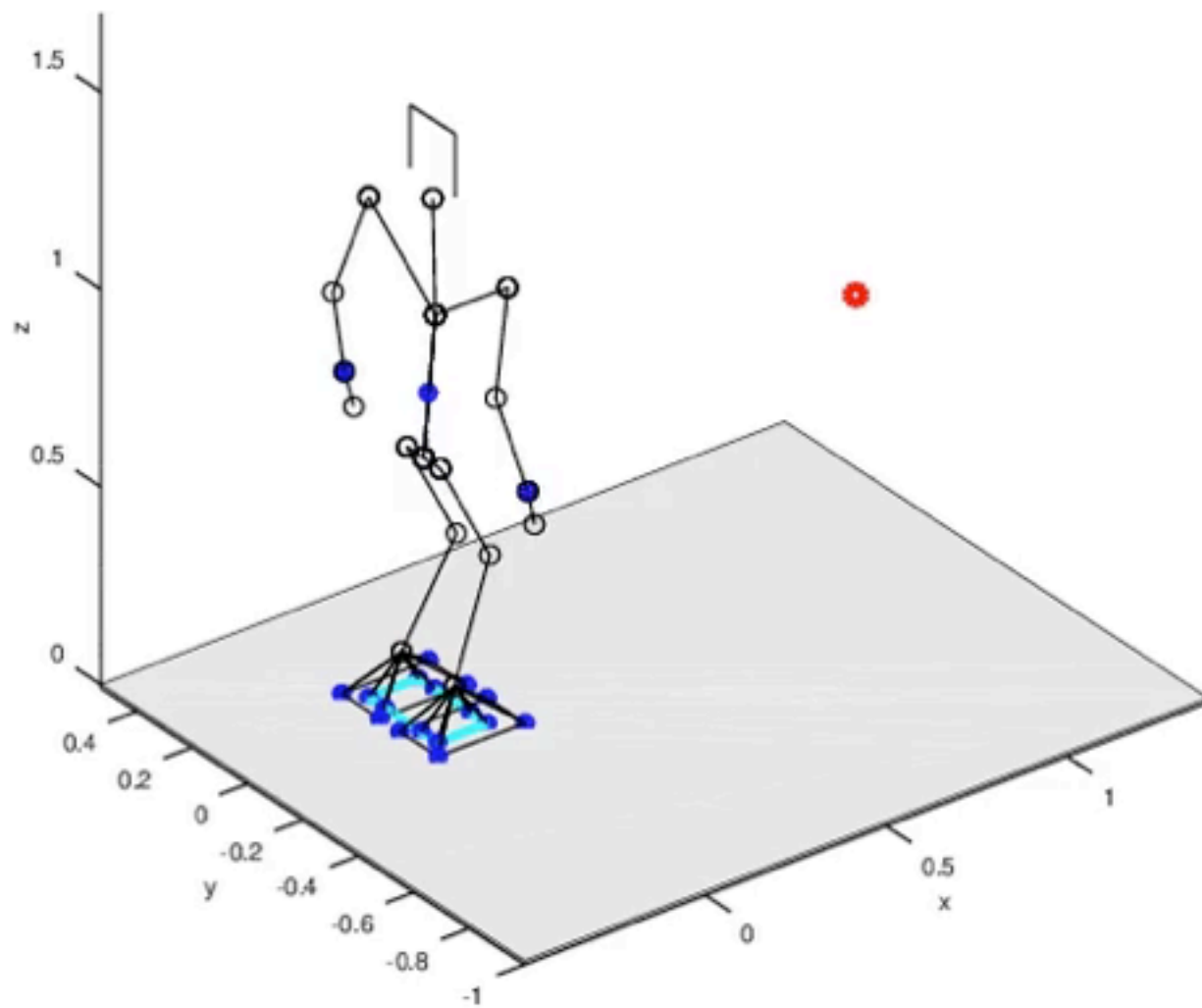# Ögren 2011 JIRS

# Kanoun 2011 ITRO

# Kanoun 2011 ITRO

# Reaching a target…

$$(\text{Dynamics}) \succ (\text{Target}) \succ (\text{Do nothing})$$
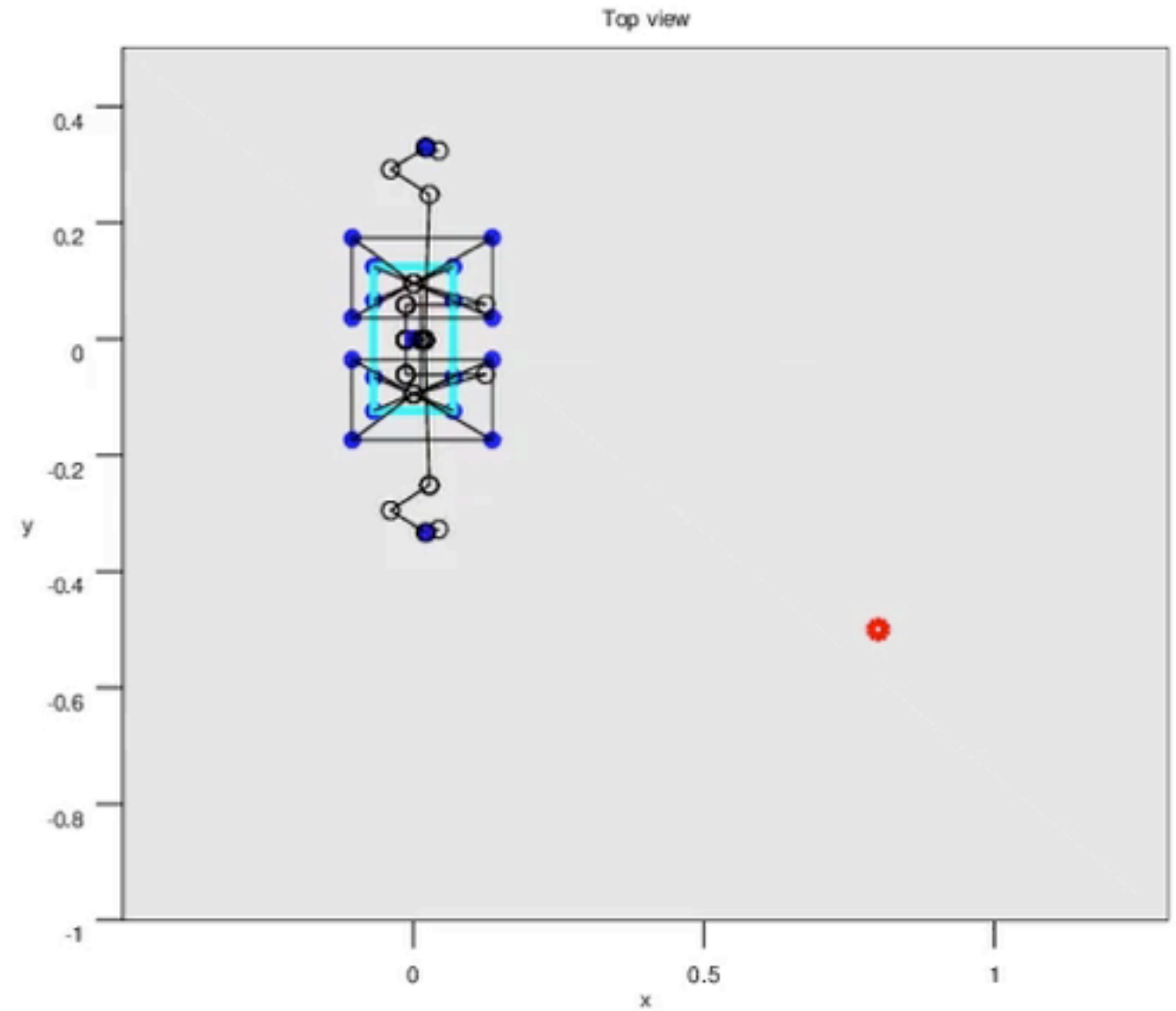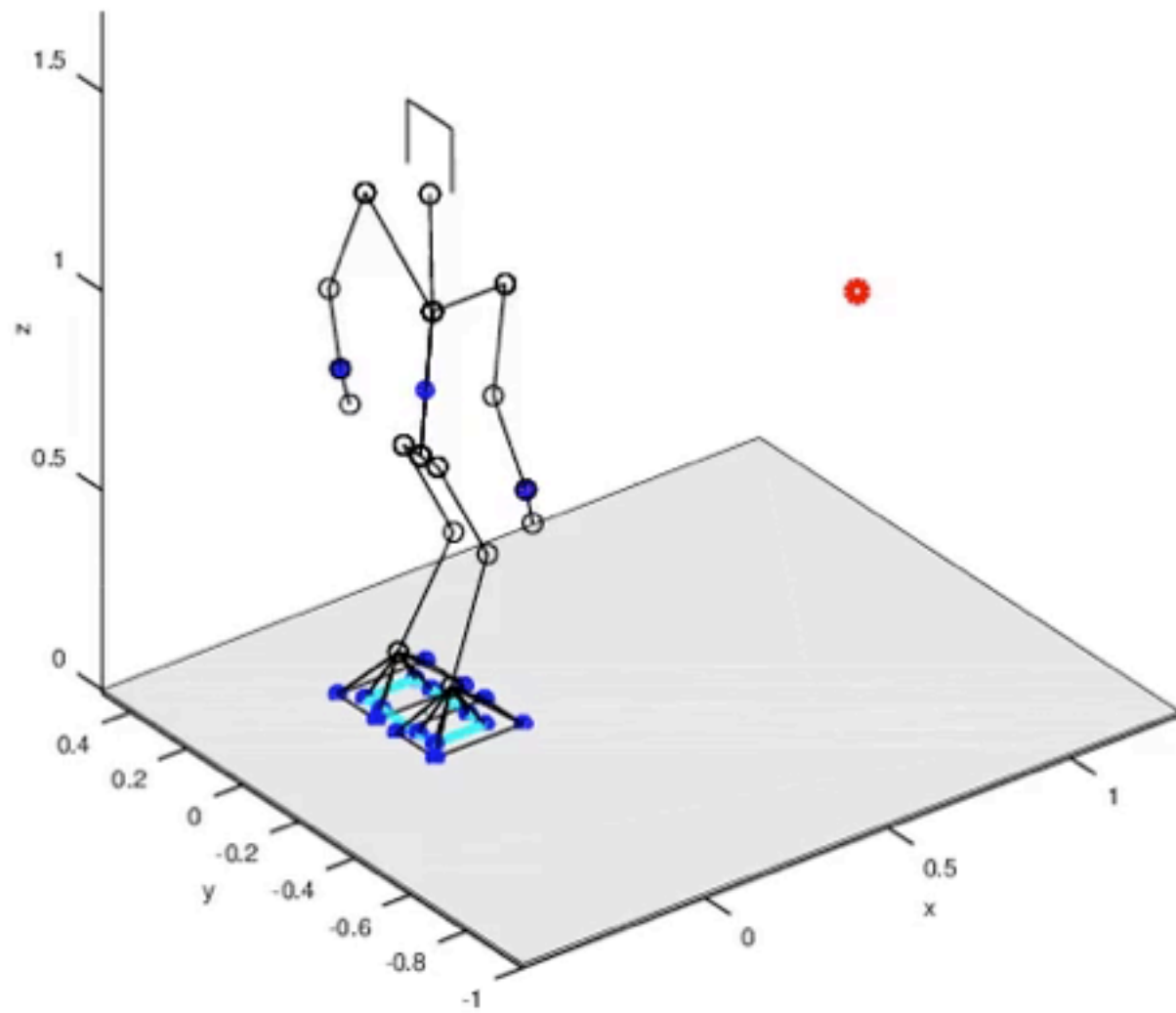
# Reaching a target…

# Reaching a target…

# Reaching a target…

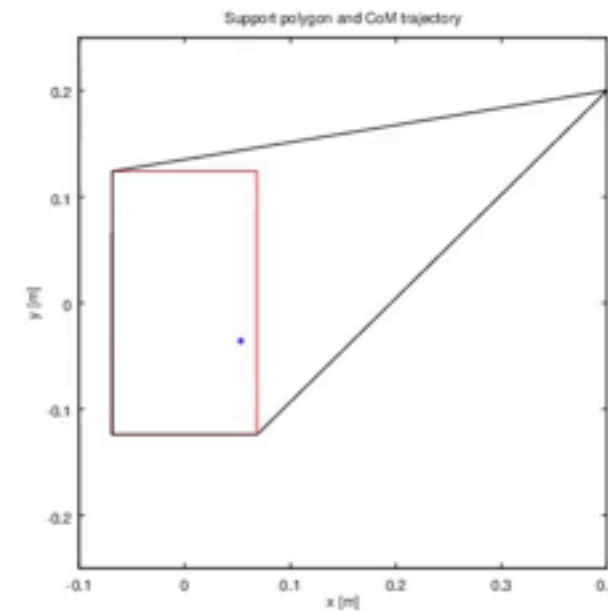$(\text{Dynamics}) \succ (\text{Do not fall}) \succ (\text{Target}) \succ (\text{Do nothing})$
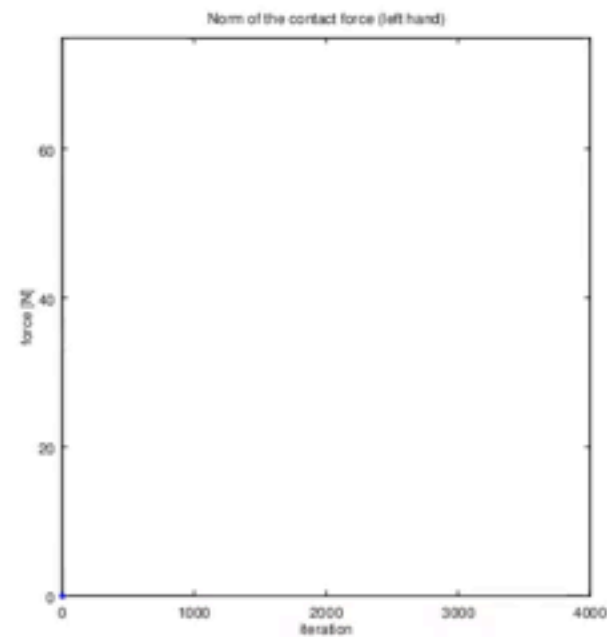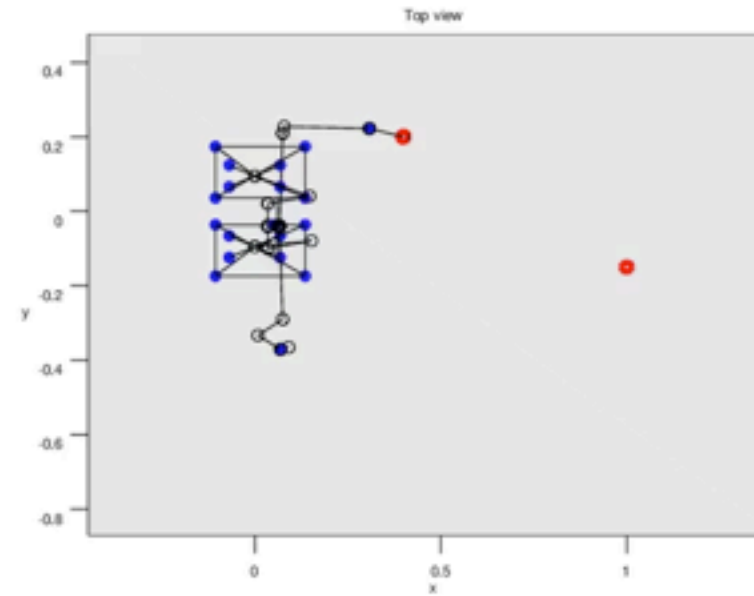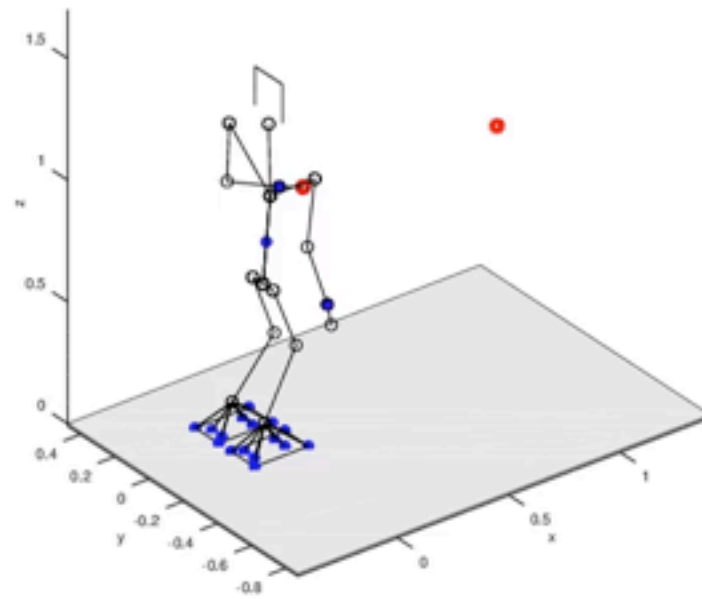
# Reaching a target…

# Using hand support

$$(\text{Dynamics}) \succ (\text{Do not fall}) \succ (\text{Target}) \succ (\text{No hand support})$$
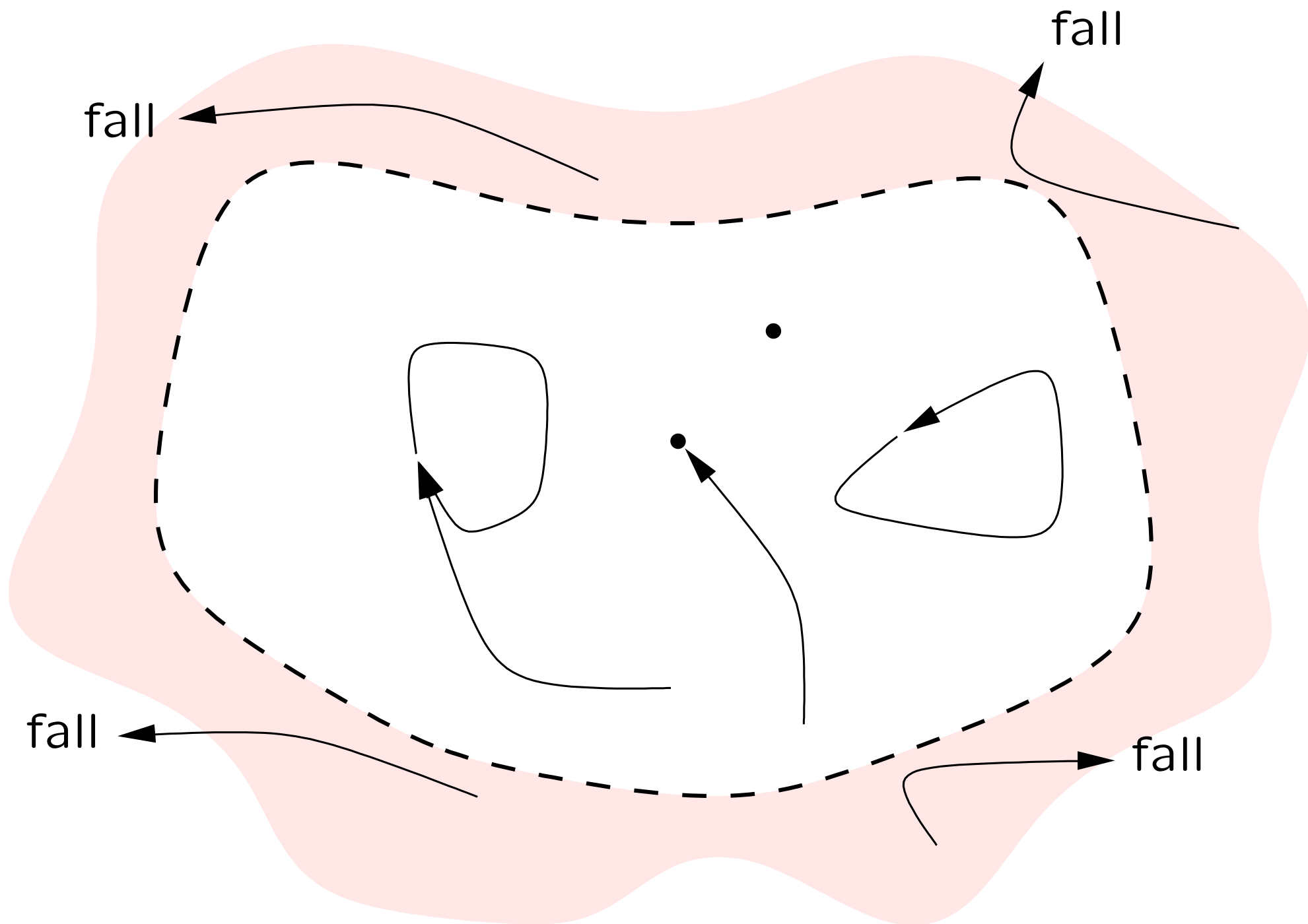
# Using hand support

# Do not fall

# Kerry Skarbakka

# Viability & capturability

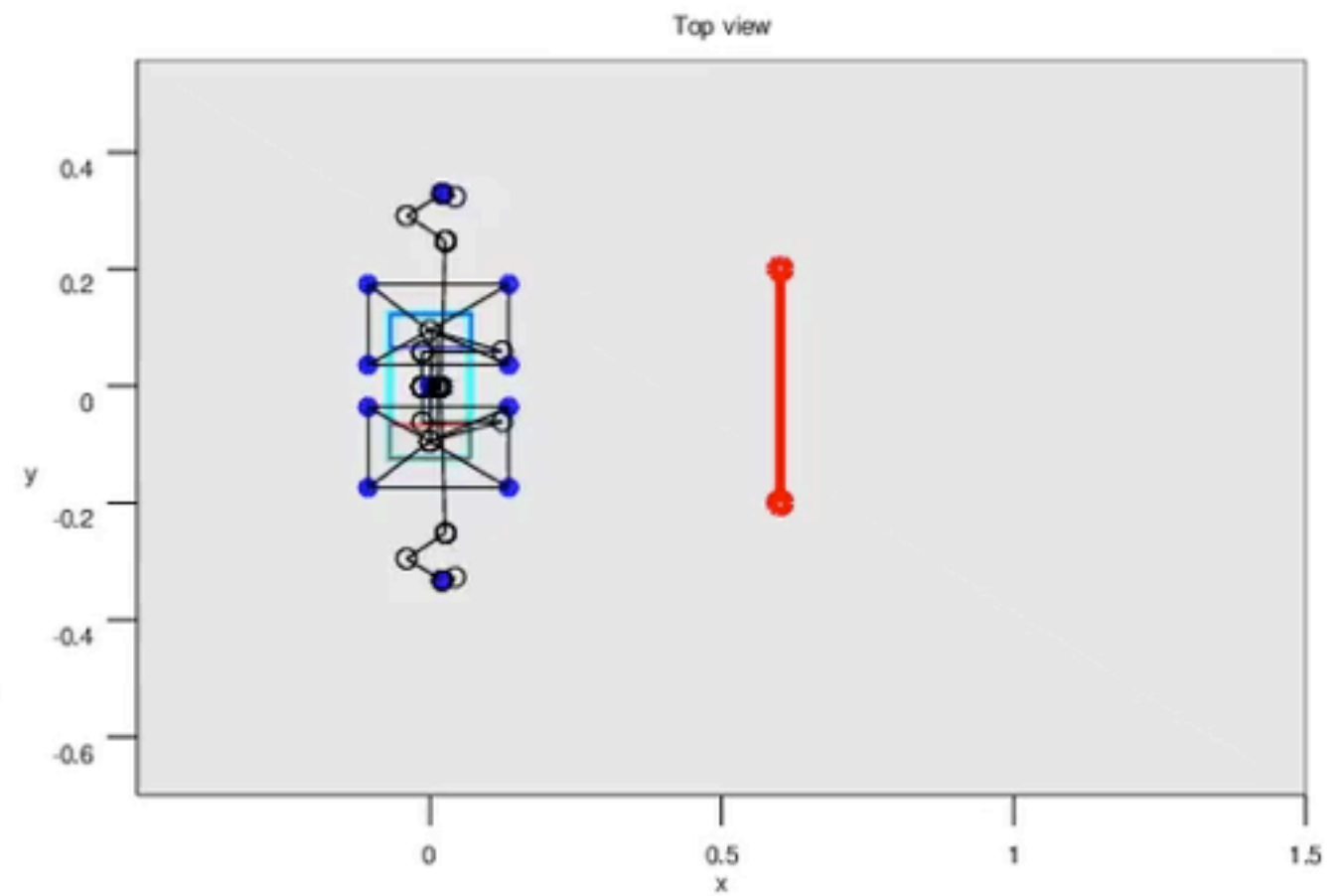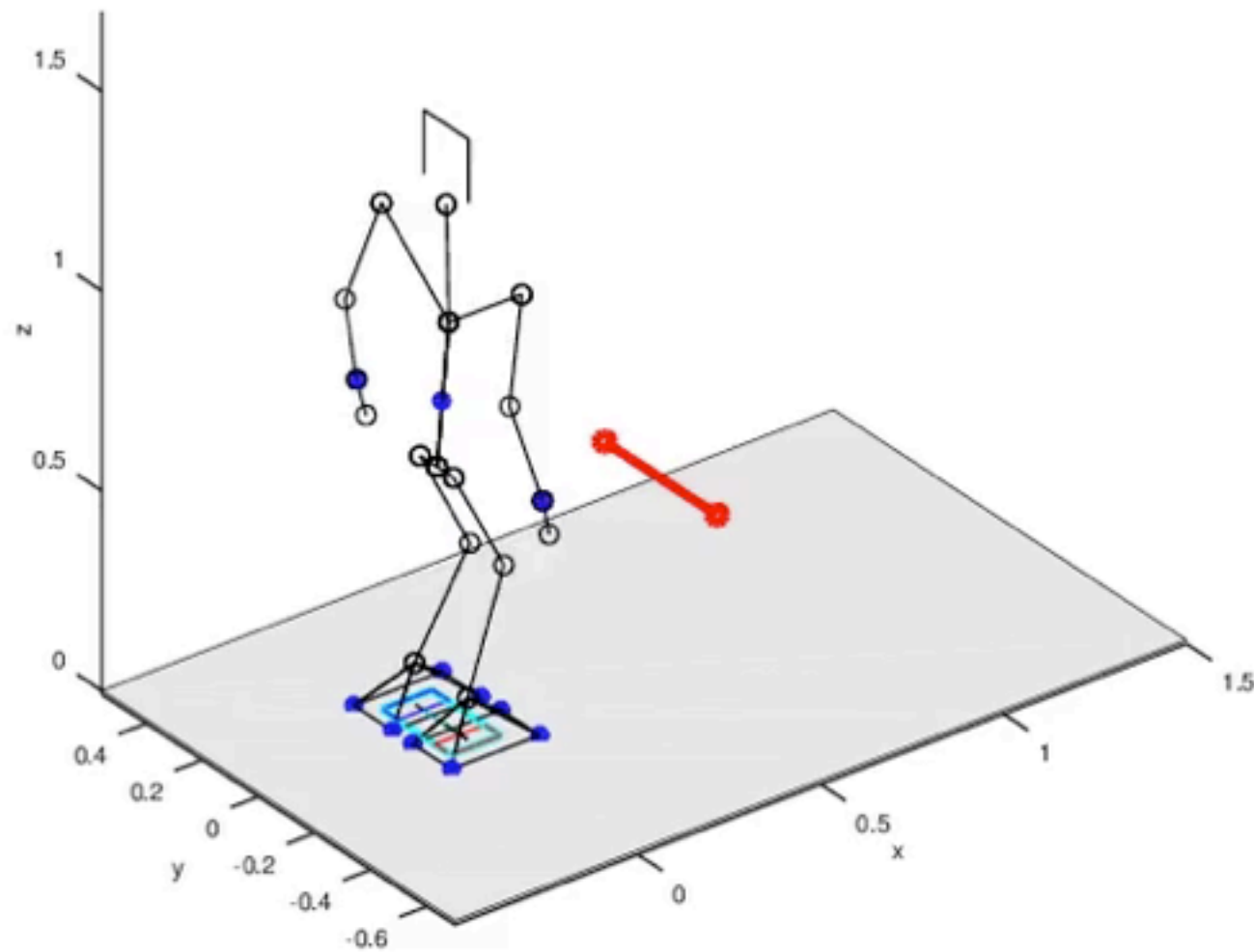# Reaching a target, and walking

$$(\text{Dynamics}) \succ (\text{Do not fall}) \succ (\text{Target}) \succ (\text{Do nothing})$$
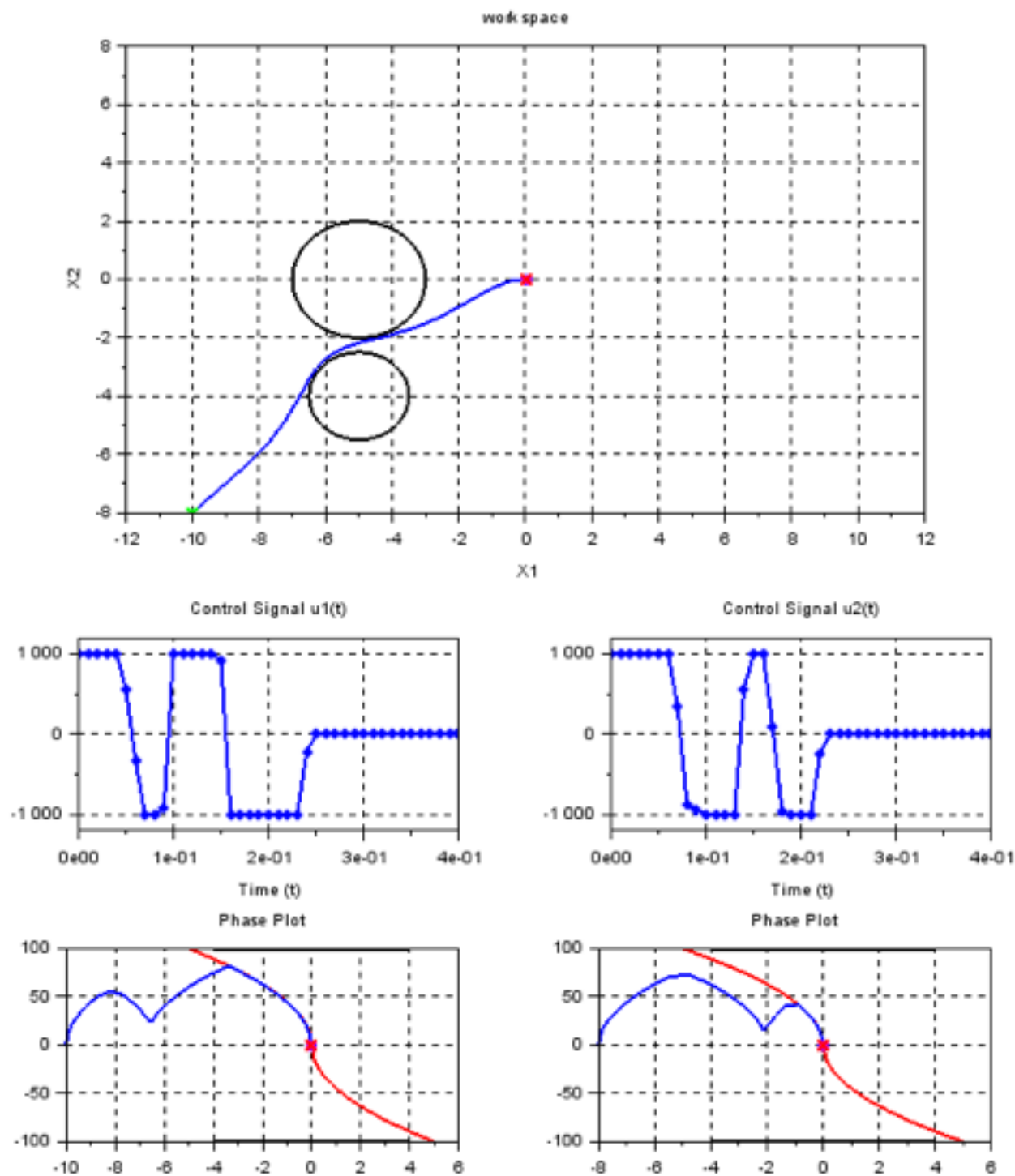
# Sherikov 2014 ?

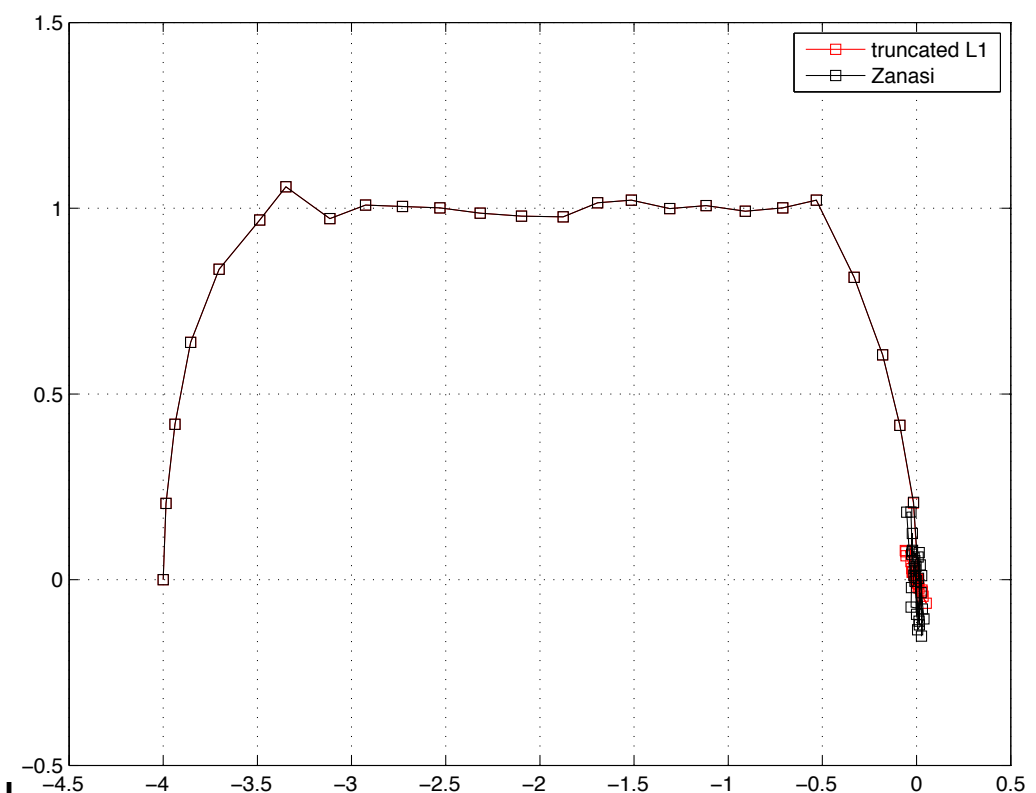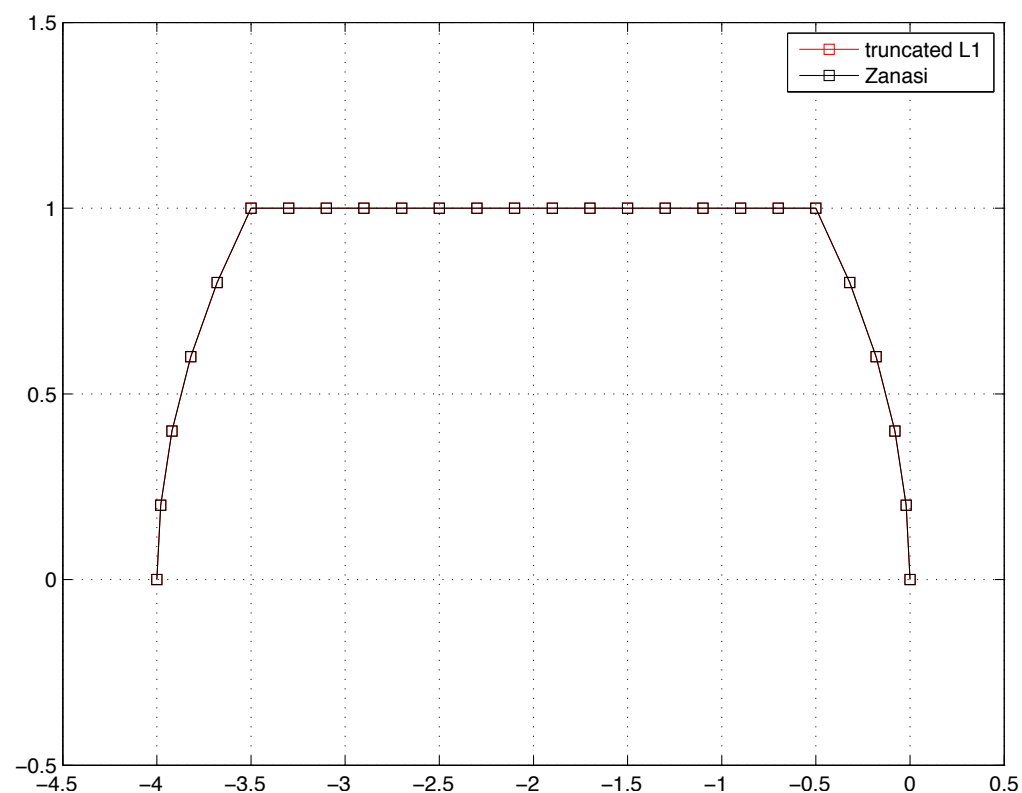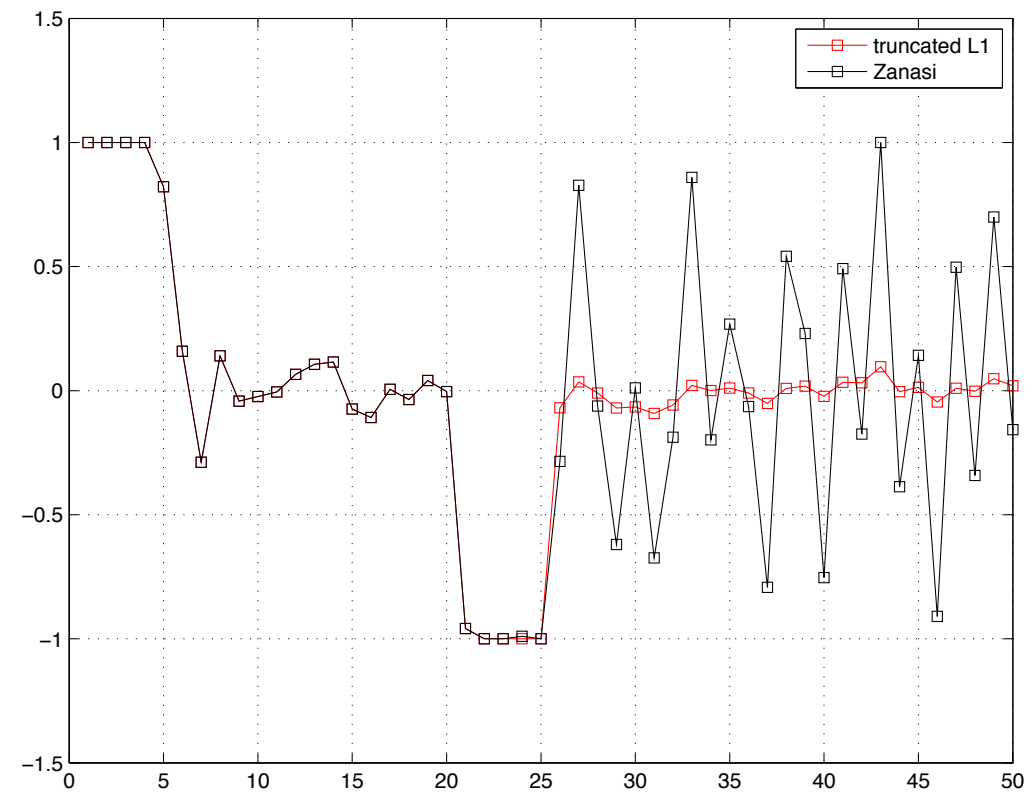Walking towards a moving target.

# Sherikov 2014 ?

# Time optimal control

$$(\text{Dynamics}) \succ (\text{Avoid obstacles}) \succ (\text{As fast as possible})$$

# al Homsi 2014 ?

# al Homsi 2014 ?

# Time optimal control

$$(\text{Dynamics}) \succ (\text{As fast as possible if far}) \succ (\text{Stay smooth})$$
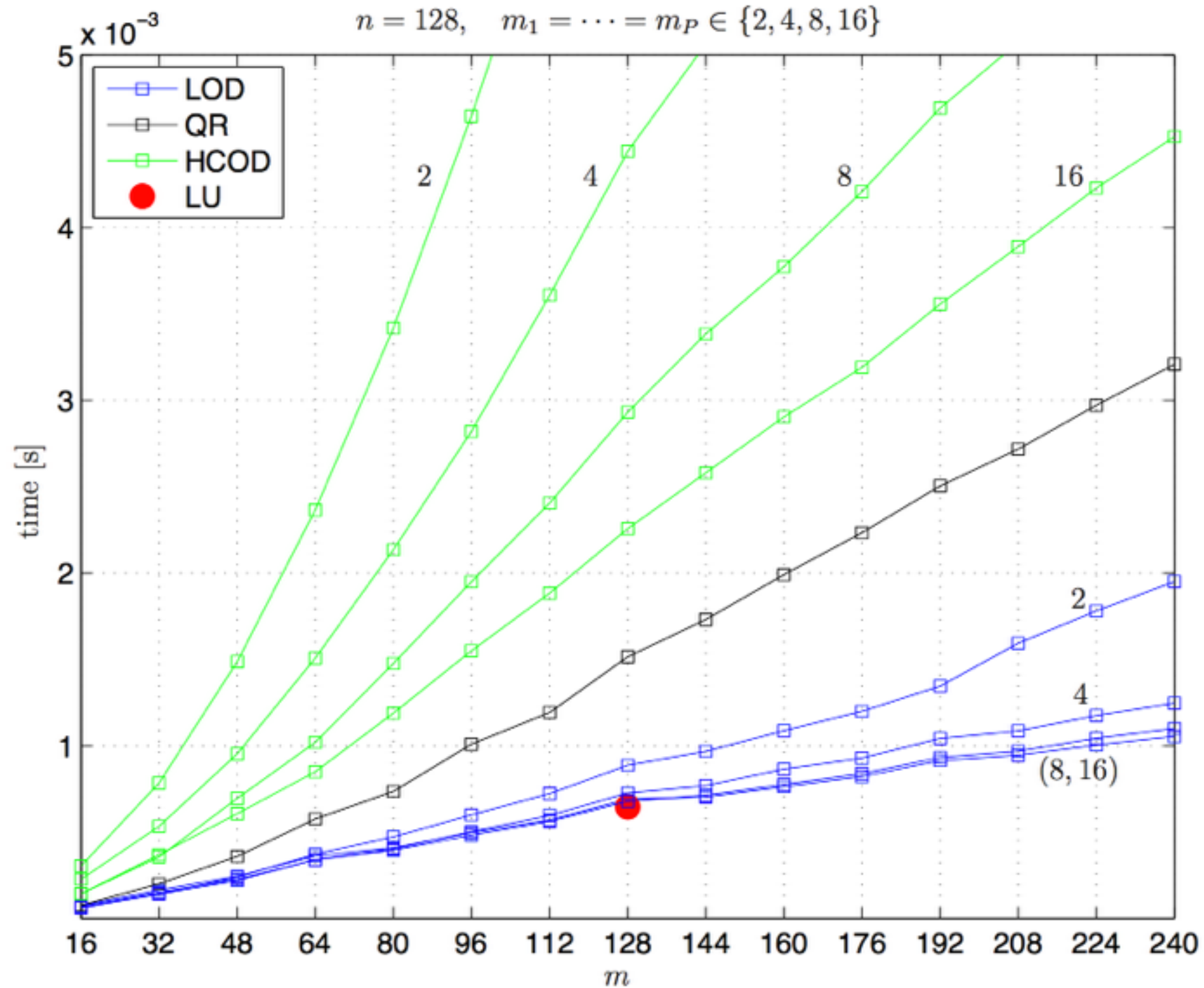
# Lexicographic Optimization

# Dimitrov 2014 ?
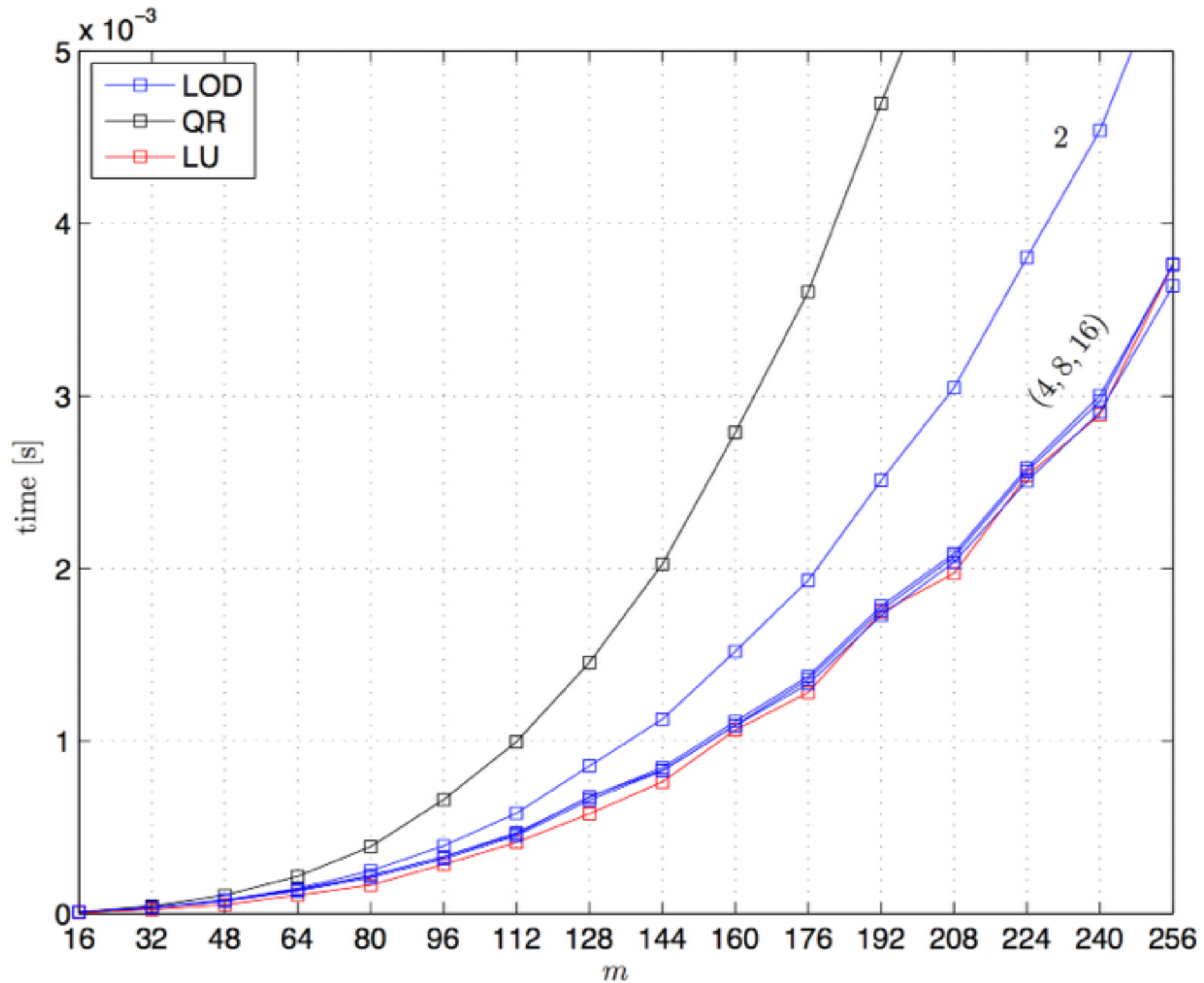
- A hierarchy is faster to solve

- As fast as solving $A\,x = b$

- Can't be faster in the general case

# Dimitrov 2014 ?



$$n = 128, \quad m_1 = \cdots = m_P \in \{2, 4, 8, 16\}$$

# Dimitrov 2014 ?

# A single problem

- Singularity ! (ill-conditioning)

# Their work



Alexander Sherikov    Saed al Homsi    Dimitar Dimitrov