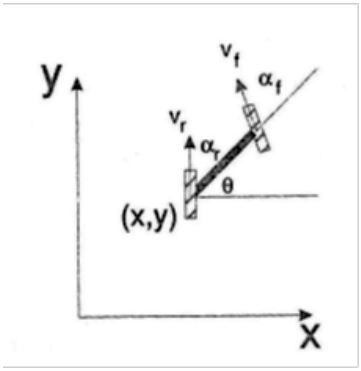
Autonomous Mobile Robots (5082AUMR6Y, Fall 2013)
Examination: Locomotion & Perception

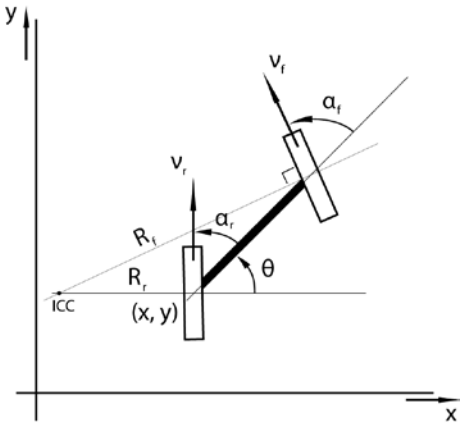
Friday November 22th, 13:00-15:00, F1.02

Toto van Inge & Arnoud Visser

Question 1

Consider the two-steerable-wheeled bicycle sketched in Figure 1. This is a bicycle in which the front wheel (wheel 1) is powered, whereas the rear wheel just rolls on the ground. The front wheel makes an angle



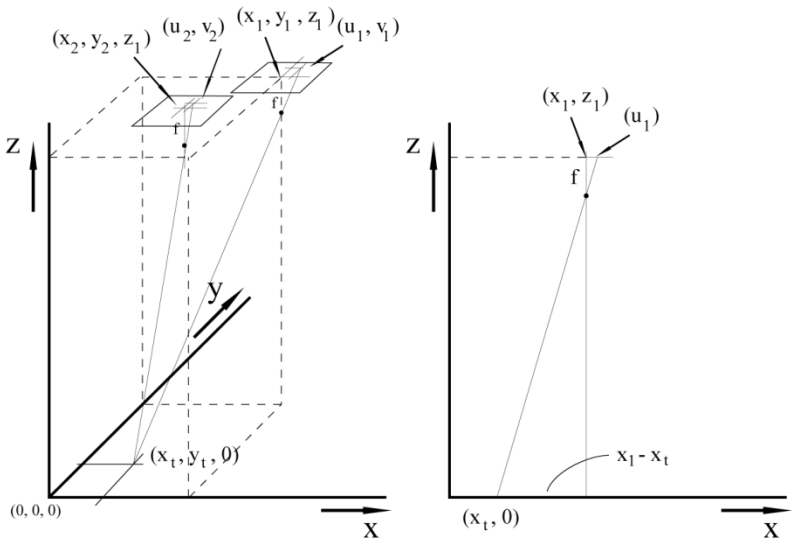


b) Under what conditions does the ICC exist?

Answer b)

Question 2

A free flying blimp robot that has fixed roll and pitch orientations (i.e. both are equal to zero), is flying over a target. The robot has a special GPS system that gives it PERFECT knowledge of its location in 3D space (i.e.



Question 3

Consider an eight-legged crab robot walking sideways (see figure 2).

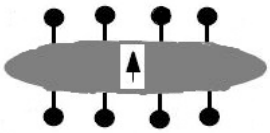


Figure 2. Arrow depicts walking direction,

Figure 3 shows that the legs has 2 degrees of freedom.

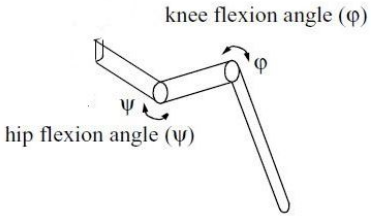


Figure 3. A leg with a fixed hip

Consider gaits in the terms of lift/release events and use the notation illustrated in figure 4.

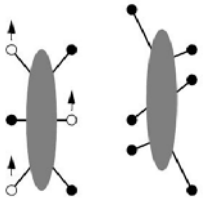
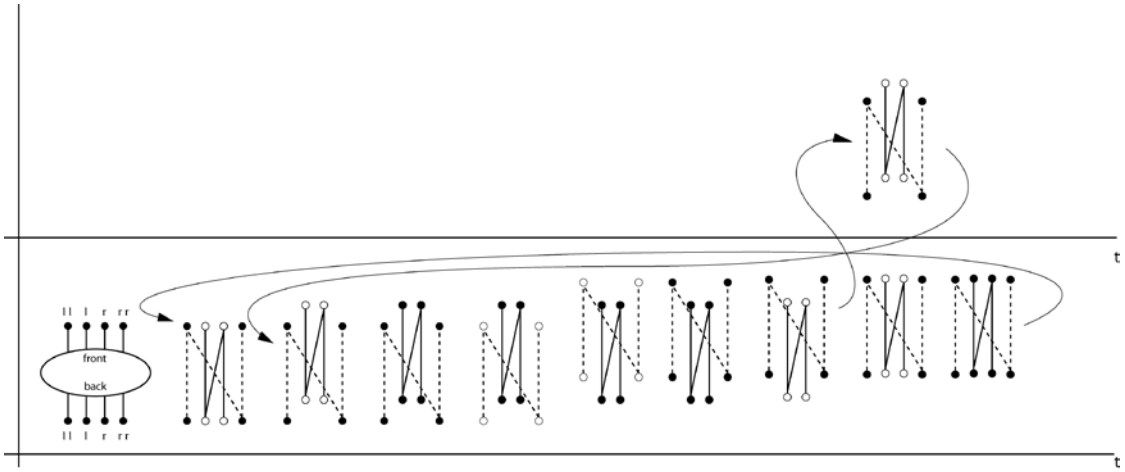


Figure 4. Gait notation example

a) How many possible events exist for this eight-legged machine?

Answer a)


x
front
back
t


front
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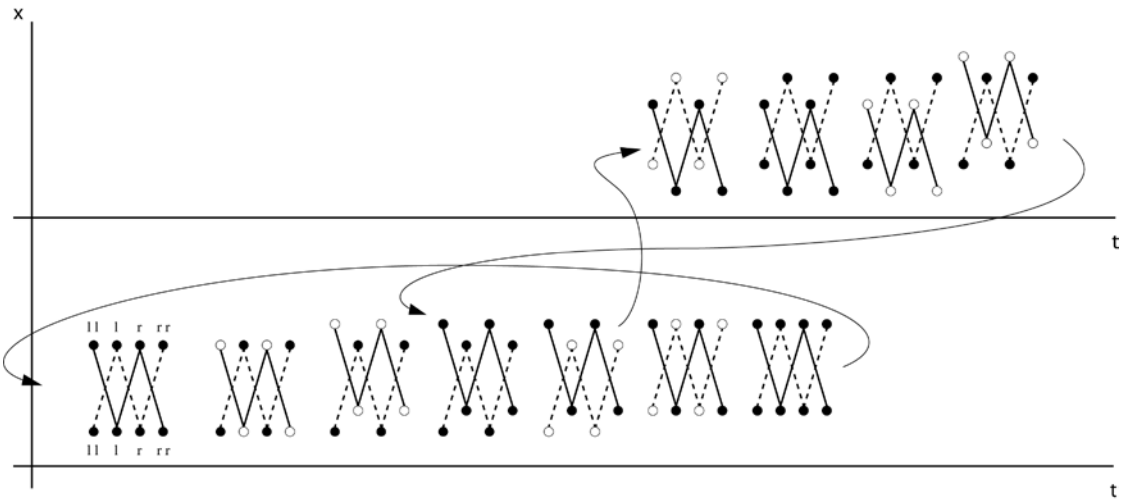
x
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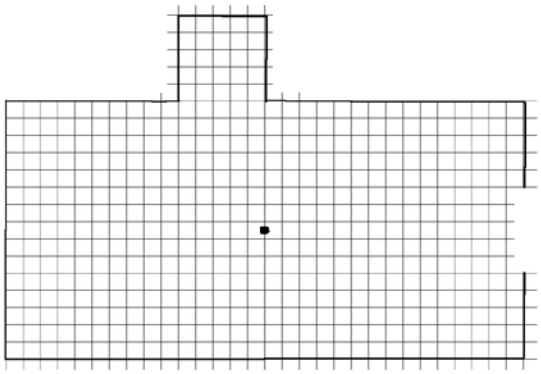
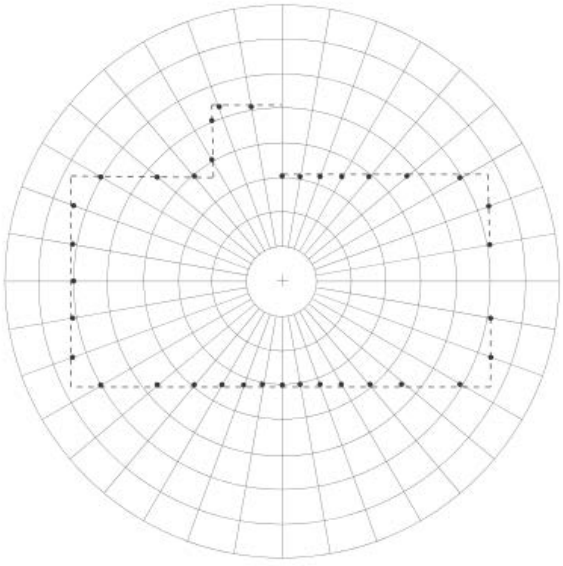
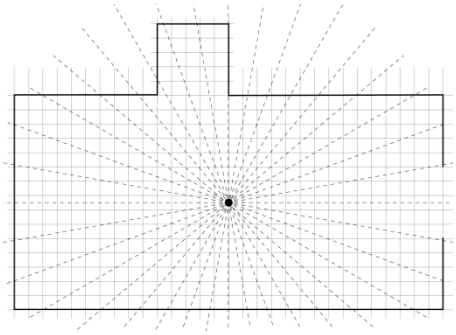
Question 4

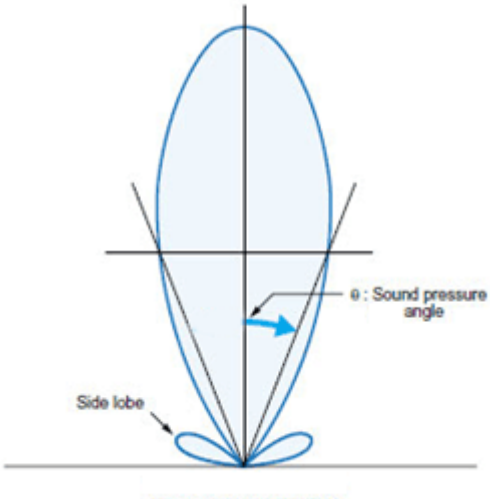
Assume the following slightly idealized model of ultrasonic sensing: the senor returns a signal whenever an object within

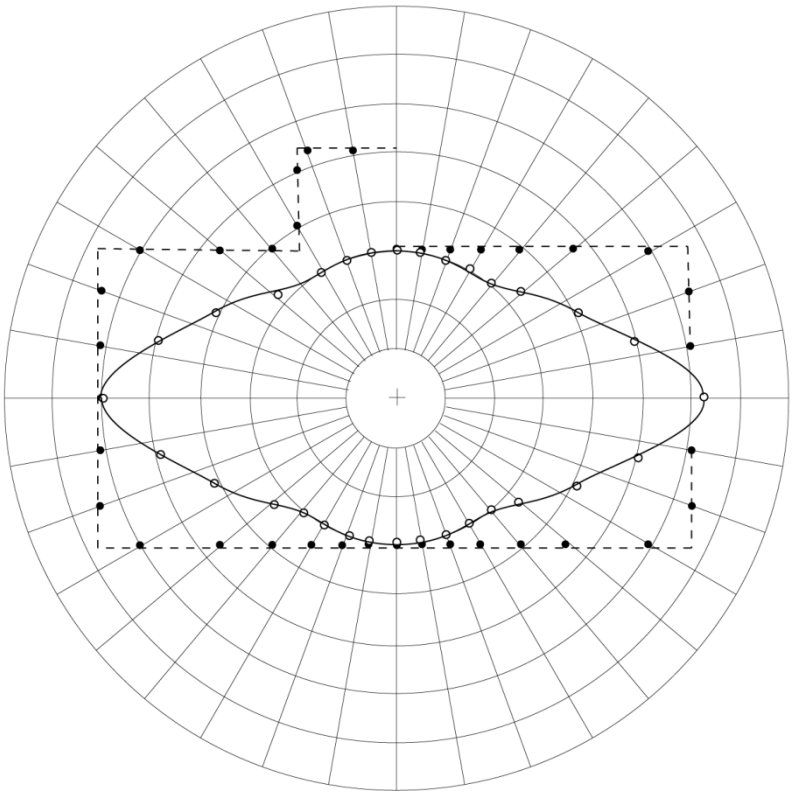






In case the directional characteristics are depicted by figure 6 (neglect the side lobes) with





Acknowledgement
Question 1 and 4 are originally from the textbook 'Computational Principles of Mobile Robotics', by Gregory Dudek and Michael Jenkin, Cambridge University Press 2000. However question 4 is extended.
Question 2 is used as practice mid-term exam at Princeton University.