



## Mestrado em Engenharia Electrotécnica e de Computadores

### ROBÓTICA MÓVEL

Ano Lectivo 2004/2005

#### Homework 1

Handed-in: 1/4/2005

Due: 15/4/2005

1. What is the difference between *external* and *internal* sensors of a mobile robot? Illustrate your answer with examples from both classes.
2. List the most common *range* sensors used in mobile robots, as well as their relative advantages and disadvantages. Provide examples of situations where some type of range sensor is preferable to another type.
3. Explain how (rate-)gyros work as sensors, and how they can be used to estimate the orientation of a mobile robot, listing the (dis)advantages of this method. Can a gyroscope be used to measure the inclination of a mobile robot with respect to the horizontal plane? How (attach some drawing to illustrate your answer).
4. Read carefully the paper "Sensor Models and Multisensor Integration", de H. Durrant-Whyte, *en Autonomous Robot Vehicles*, I. Cox, J. Wilfong (editors) [1], and elaborate, synthetically, on how could one use the sensor integration method described there be used by a 3-robot team to improve the localization of an object perceived by all 3 robots. Assume that each robot has *at least 2* sensors: one infrared sensor (IR), providing range information, and a stereo vision sensor, providing range information as well. Each robot can use either only one or both of its sensors. Different robots can communicate to combine the information each of them gets from one or both sensors, e.g., one uses vision only, and the other uses IR and vision. The robots are in general located in different positions/orientations in the working space. Use a probabilistic model of sensor observation uncertainty appropriate for each sensor. Explain how would you obtain the other models in Durrant-Whyte's method, and how would you combine the information from every sensor in the team.

#### Reading Assignments

1. Hugh F. Durrant-Whyte, "Sensor Models and Multisensor Integration", in *Autonomous Robot Vehicles*, I. J. Cox, G. T. Wilfong, eds, Springer-Verlag, 1990.