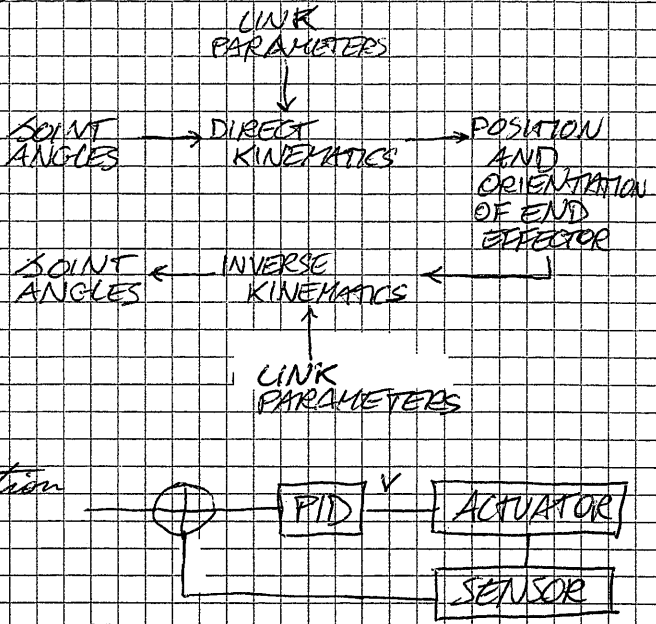
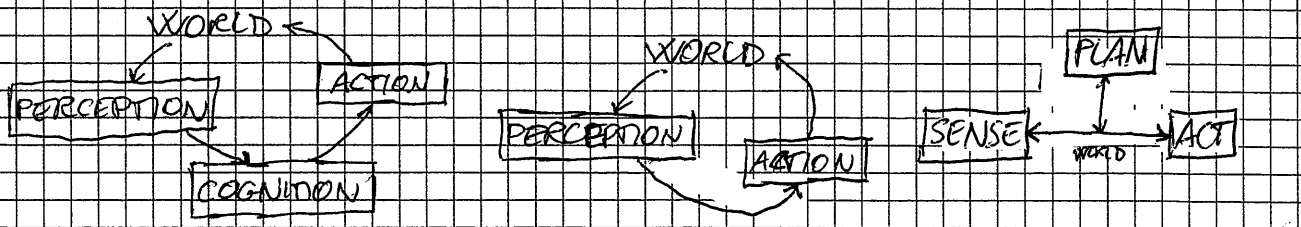
HUMAN AND ANIMAL MODELS IN BIOROBOTICS
CECILIA LASCHI

TRADITIONAL AND MODERN ROBOTICS

Control mechanism of a traditional robot are represented. They are based on the assumption of a well defined operating space.
Now the environment is unstructured; so, now robots need perception of where they are. This concept changes their behaviour, because they will now use perception in some kind of reasoning, to modify it during the process.
Now intelligence is not only logic, but also interaction and perception of physical world, in order to have good internal representation of it



INTERACTION MODELS WITH PHYSICAL WORLD



The second one is a should be additive. You could add as many behaviours as you want, without interference. Actually, you have to compete with concurrence of resources, for example through priority levels. In this behaviour, you don't know the output, instead of the first model. Third one is a hybrid approach

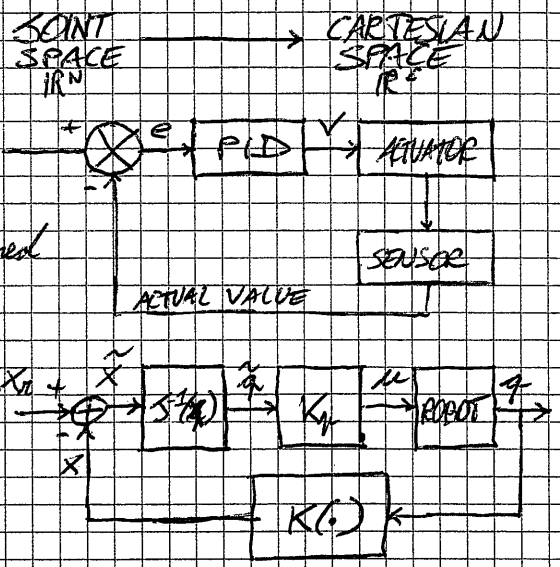

master
COPY
COPISTERIA


master
COPY
COPISTERIA

TRADITIONAL AND MODERN ROBOTICS

Robotics was born for industrial manufacturing, where environment is structured and does not need to be explored. Robot is programmed to reach objects in precise positions. Kinematic models of the robot can be expressed through Denavit-Hartenberg parameters. Then, you set the position (and orientation) of robot's end effector, and by this, these configuration of joints will be inferred. Then, the position and orientation will be performed adjusted through a PID controller, whose input-output relation is

$$V = K_p e_q + K_d \dot{e}_q + K_i \int e_q(t)\, dt$$



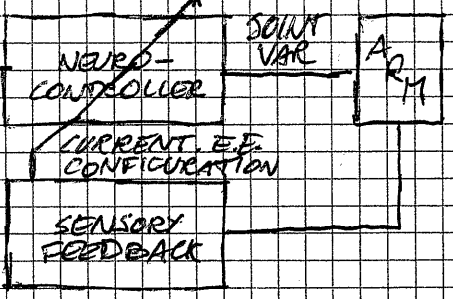
This last is a control on joint space. It is also possible a control on operative, where control loop is closed on the error between desired and current position and orientation of the end effector.

Modern robotics now deals with unstructured environment. First applications were in environments impossible to access by humans, but recently an interaction with them is also expected. By all these elements, robot needs perception of environment and intelligence for planning its behaviour by consequence and being autonomous.

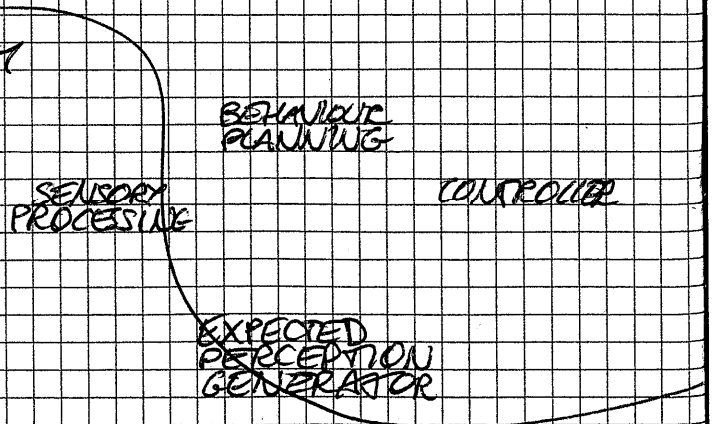
Architectures for controlling modern robots are based on 3 functions: perception, action and planning. In the hierarchical architecture, the organization is sense-plan-act. Informations are perceived through senses, then processed using the model of the world, already provided, and perform a related action. In reactive architectures, the plan is removed, since

model of the world is not needed. A SENSE-ACT couple is called behaviour. Many behaviours could be run in parallel, without any mutual interaction. Actually, subsumption architecture has been recently proposed to manage concurrency of behaviours, through priorities and mechanisms of input suppression or output inhibition.
In hybrid architecture, PLAN module is reintroduced again, which triggers reactive behaviours.

NEURO-ROBOTICS
Neurocontrollers are robot control systems that are not based on model of robot already provided, but try to learn it.
Specifically, it is used to control motor joints.
Neural networks are usually used for training. A particular type is Growing Neural Gas Network, SOM that can modify the number of cells, by increasing, growing, and reducing them. At running time, winning cell & GNG encoder motor command for robot which adjust actual position and target

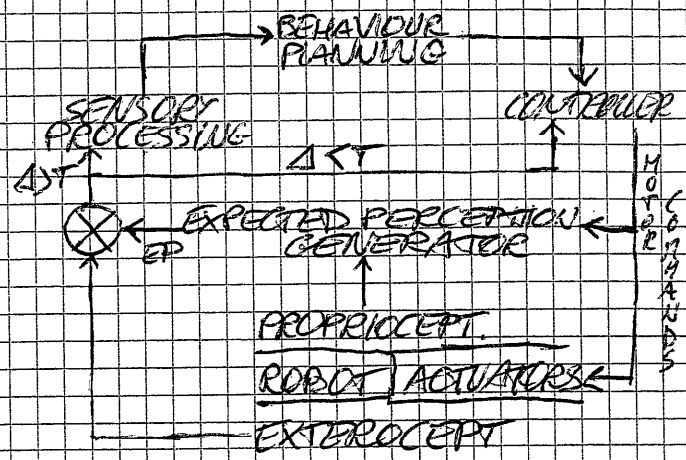


EXPECTED PERCEPTION SYSTEM



master copy

EXPECTED PERCEPTION SYSTEM



master copy system

master copy system