Components of a robot

Joints:
- We will cover robotic designs with prismatic and revolute joints
- Other joint configuration are possible

Actuators
- The actuation principle of a robot highly depends on its precision requirements, environment, cost, …

Transmissions
- The choice of a transmission is based on the chosen actuators, the required precision, the task to be performed, the allowed weight, …

Sensors
- Are used to sense position, speed, force and torque of joints or end effector.

End Effectors
- End effector vary according to the performed task. Almost everything is possible.

Degrees of freedom vs. degrees of mobility

Degrees of freedom (DoF in a d-dimensional space)

Number of independent movements an object can make w.r.t. a coordinate system

- d : translational DoF
- $\frac{d(d-1)}{2}$: rotational DoF

→ 3 DoF in 2D space, 6 DoF in 3D space

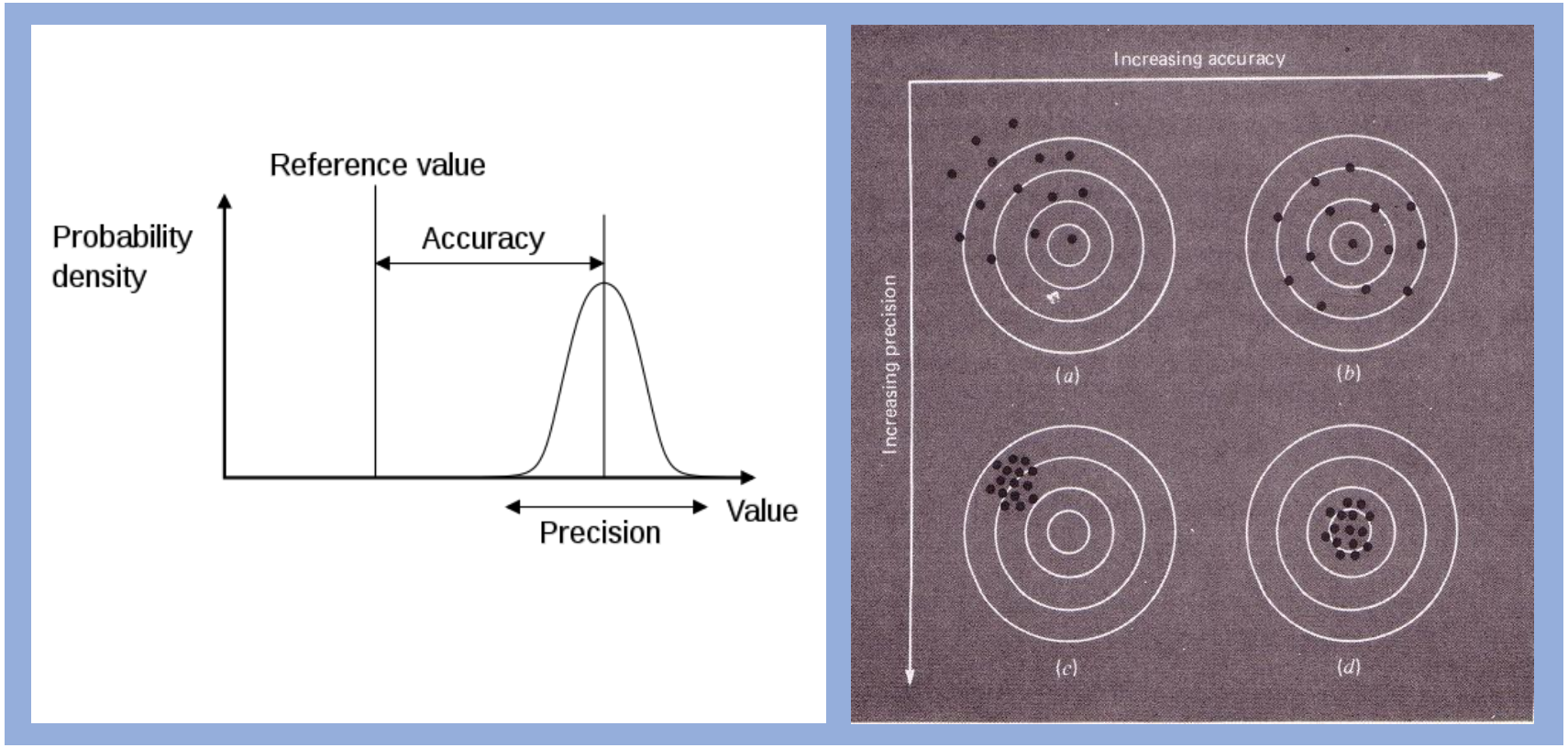
Degrees of freedom of the end effector
- Number of independent motions of the end effector
- The number of joints determines the number of DOF
- May depend on robot configuration

Degrees of Mobility of a robot
- The number of independently controlled joints on a robot

DoF ≠ DoM in the case of parallel robots or in singular configurations

Precision, accuracy, and resolution

- Precision = “Repeatability” of two or more measurements $Precision = std(M)$
- Accuracy = “Closeness” to a standard or known value $Accuracy = mean(M) - M_R$



Precision, accuracy, and resolution

Resolution

- Actuator = Smallest Commendable Distance
- Sensor = Smallest Measurable Interval