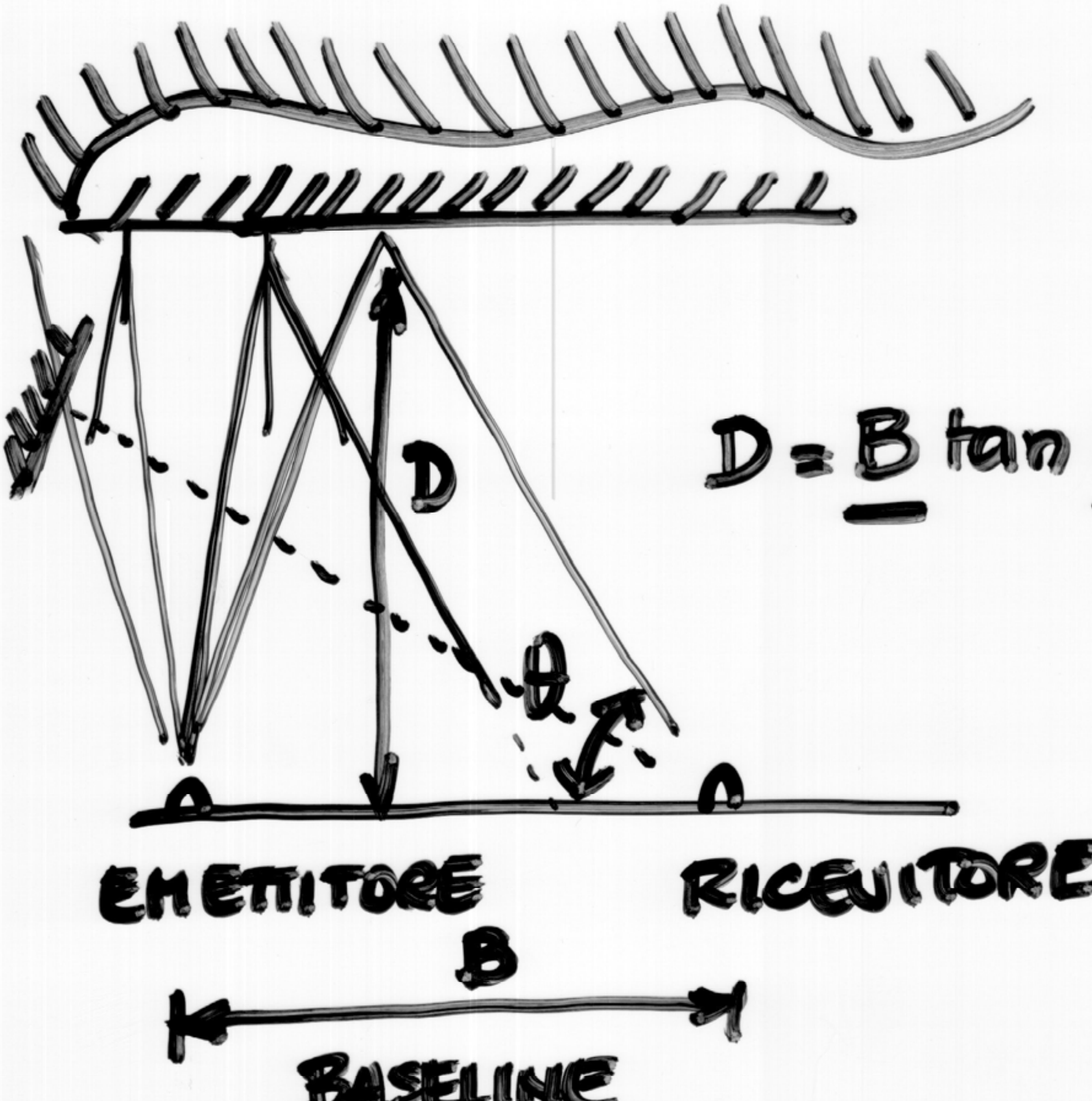
SENSORI DI DISTANZA

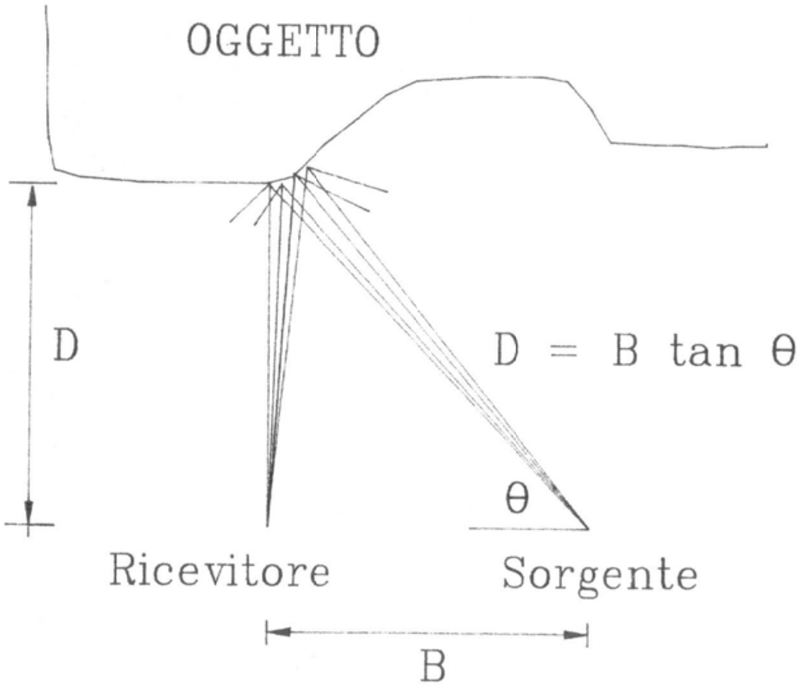
a) GEOMETRICO → TRIANGULAZIONE

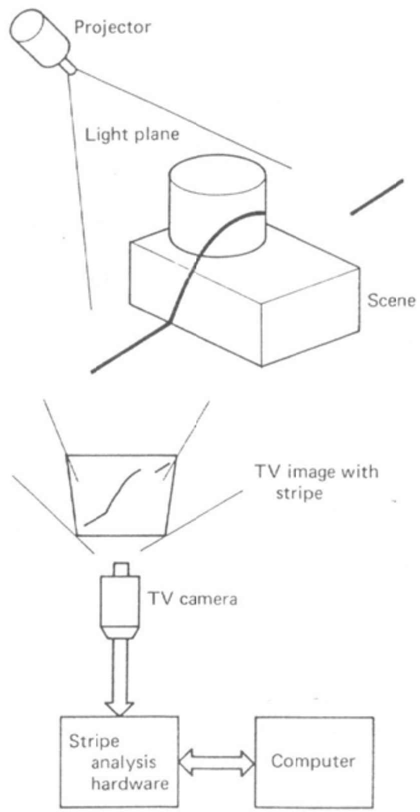
b) TEMPO DI RISPOSTA

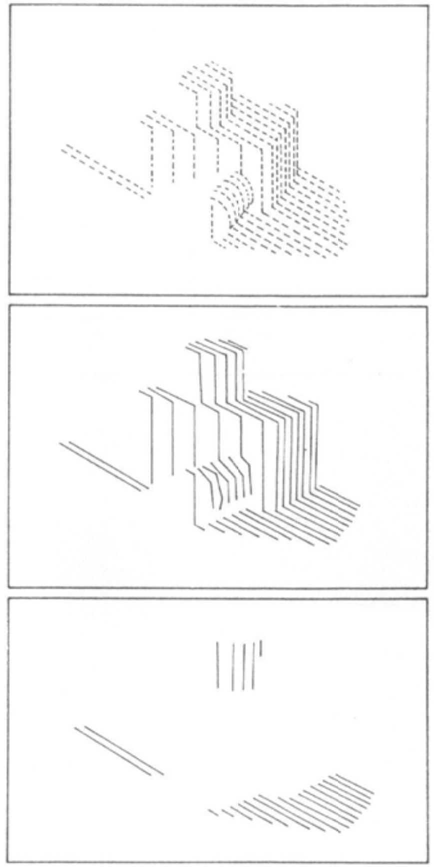


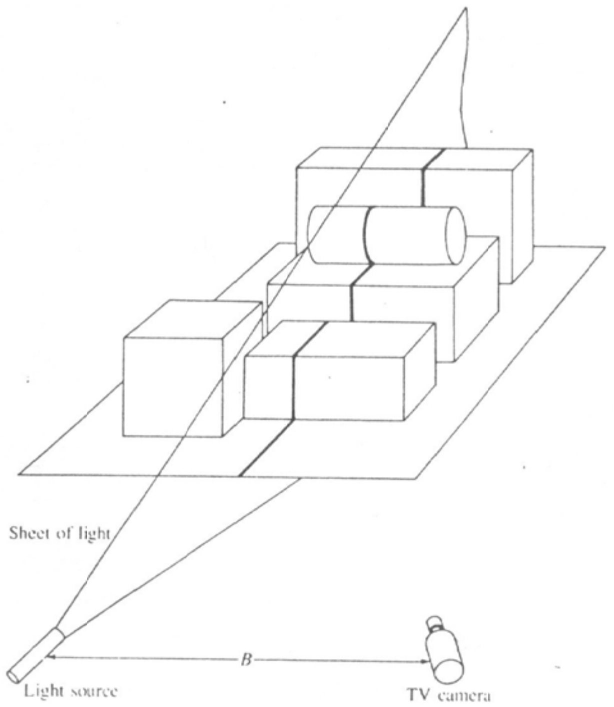
$$D = \underline{B} \tan \underline{\theta}$$

LASER SCANNER

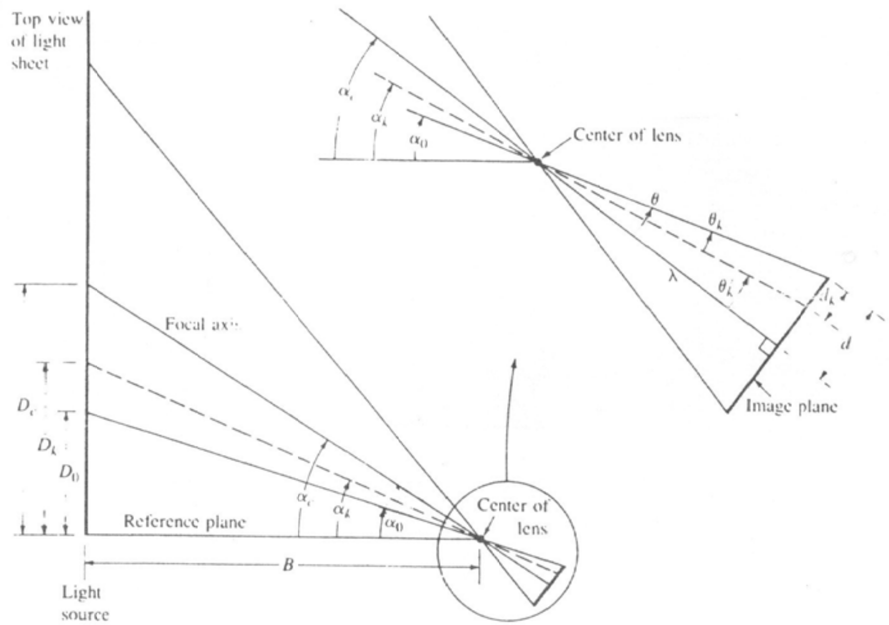

OGGETTO
D
D = B tan θ
θ
Ricevitore
Sorgente
B


Projector
Light plane
Scene
TV image with stripe
TV camera
Stripe analysis hardware
Computer

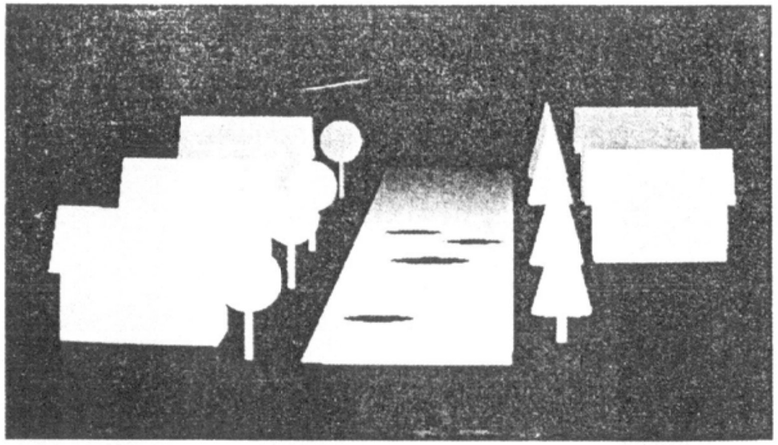




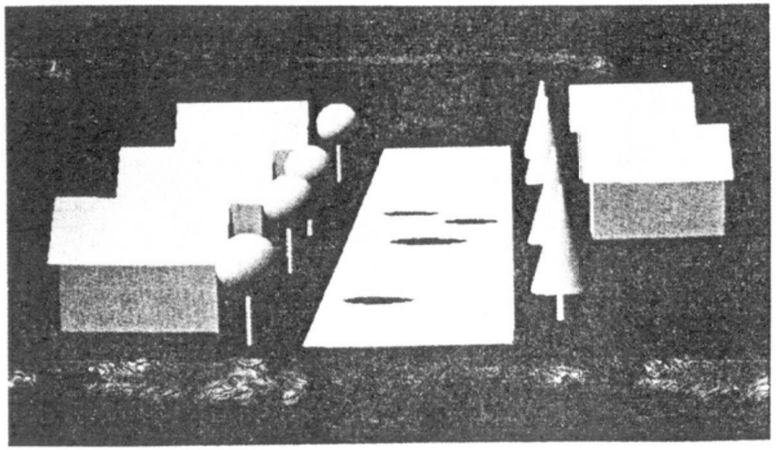
AUTOMAZIONE – IN032



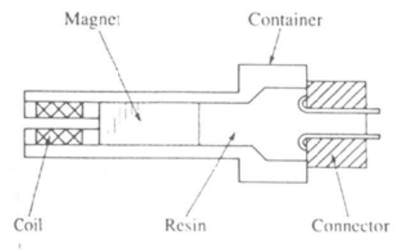
Basilio Bona – Dipartimento di Automatica e Informatica – Politecnico di Torino



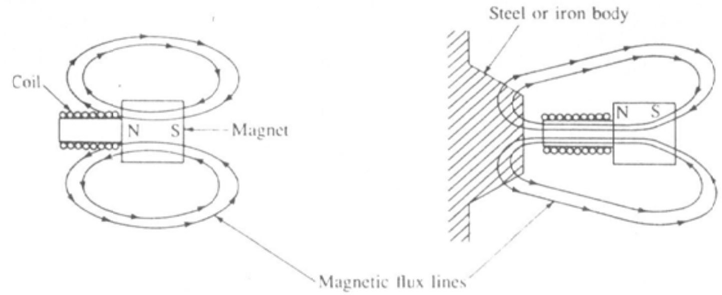
(a) Range Image

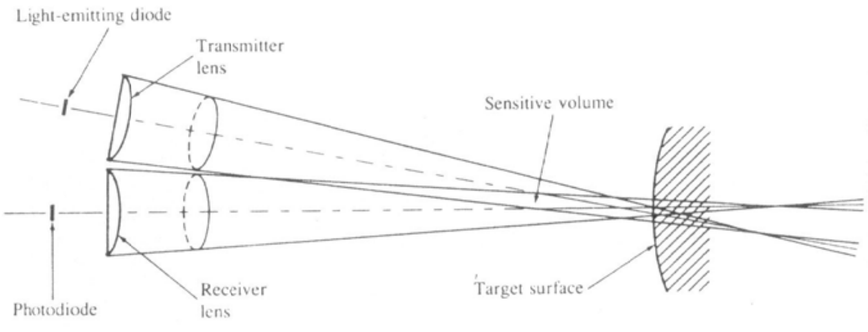


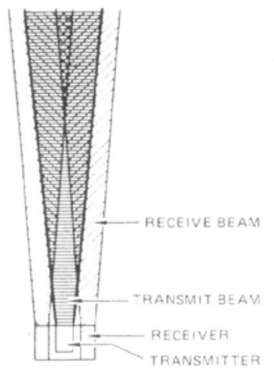
(b) Intensity Image

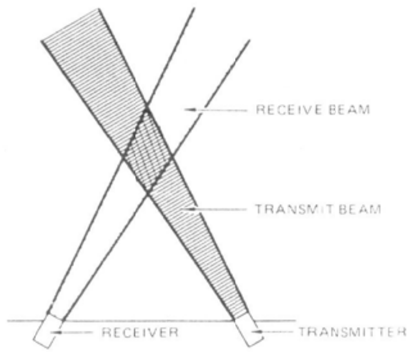


(a)

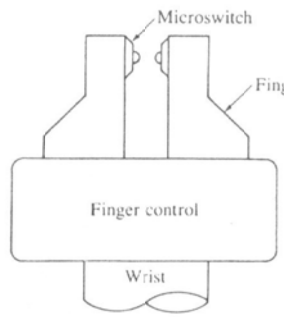


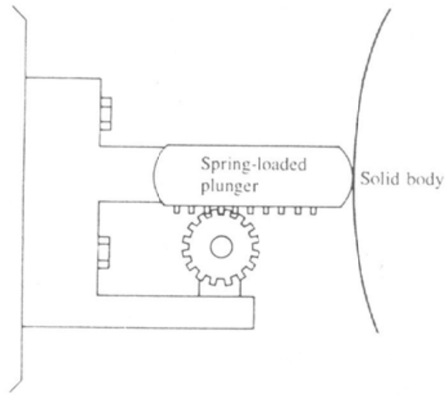


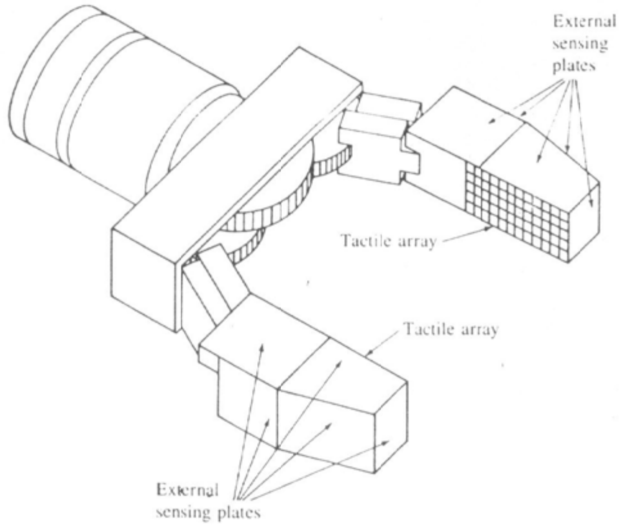




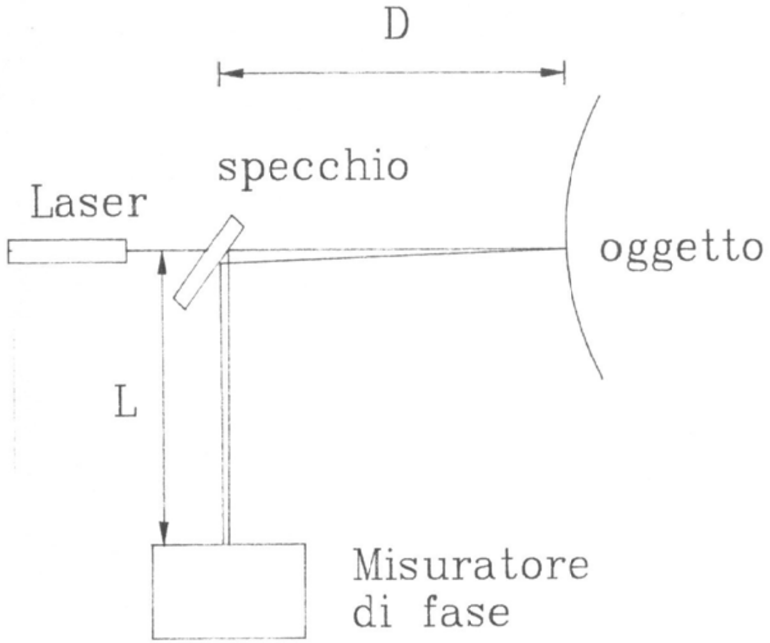
AUTOMAZIONE – IN032



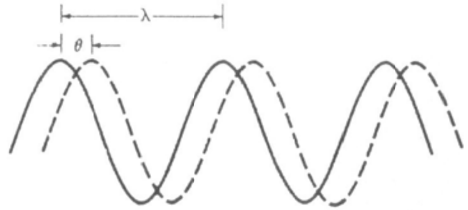


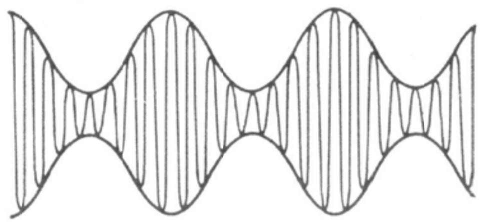


Basilio Bona – Dipartimento di Automatica e Informatica – Politecnico di Torino

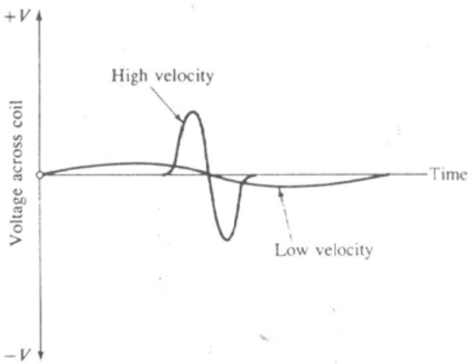


AUTOMAZIONE – IN032

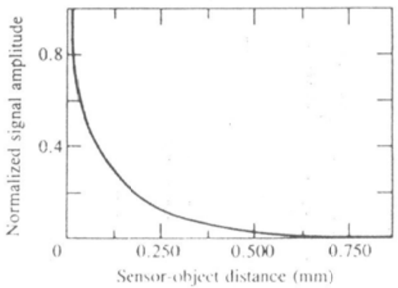




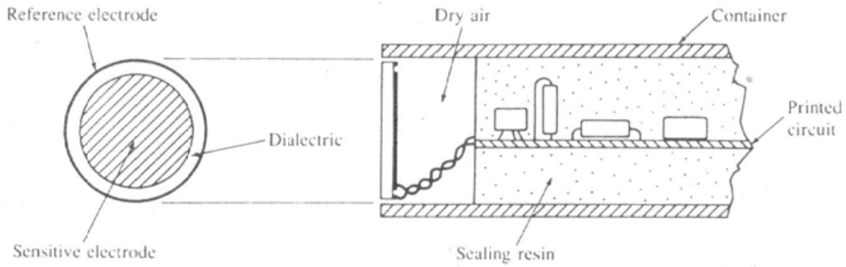
Basilio Bona – Dipartimento di Automatica e Informatica – Politecnico di Torino

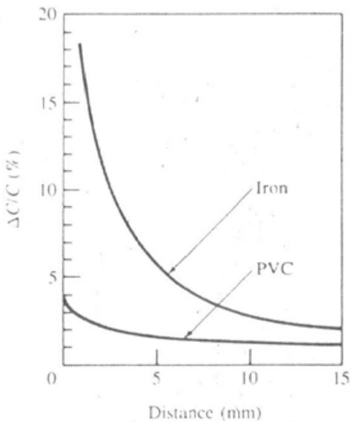

+V
High velocity
Voltage across coil
Time
Low velocity
−V

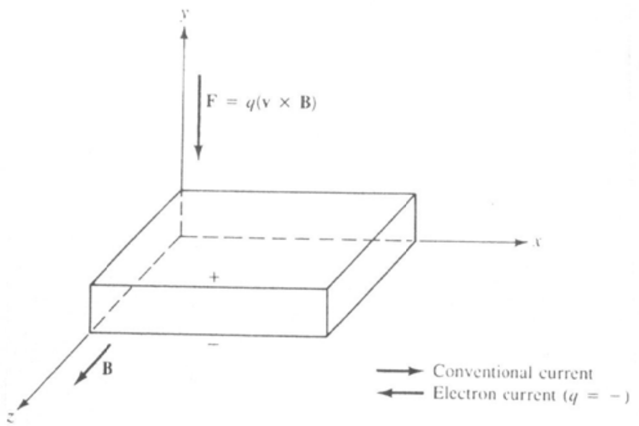
(a)

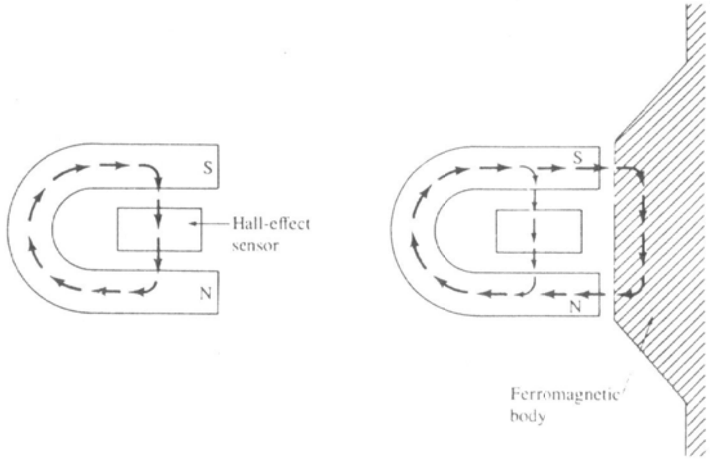

Normalized signal amplitude
0.8
0.4
0
0.250
0.500
0.750
Sensor-object distance (mm)

(b)

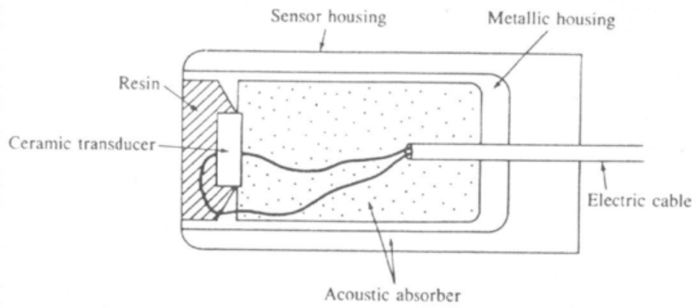

Reference electrode
Dry air
Container
Dialectric
Printed circuit
Sensitive electrode
Sealing resin

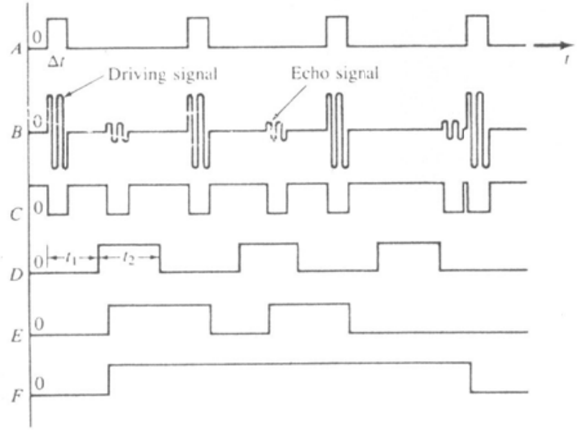

ΔC/C (%)
20
15
10
5
0
Iron
PVC
Distance (mm)



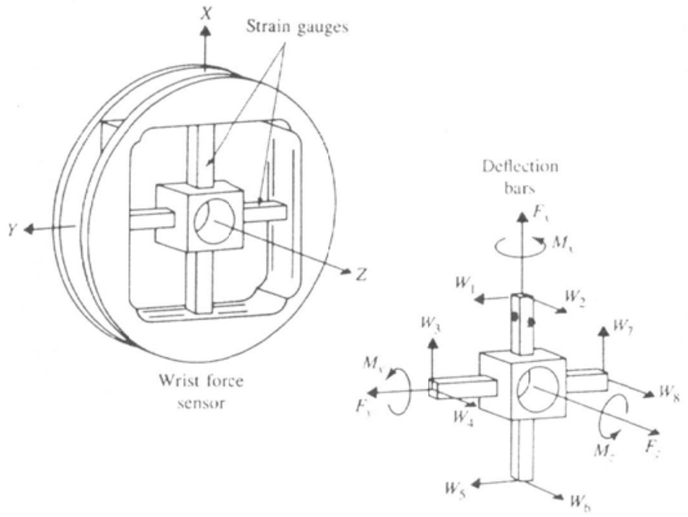


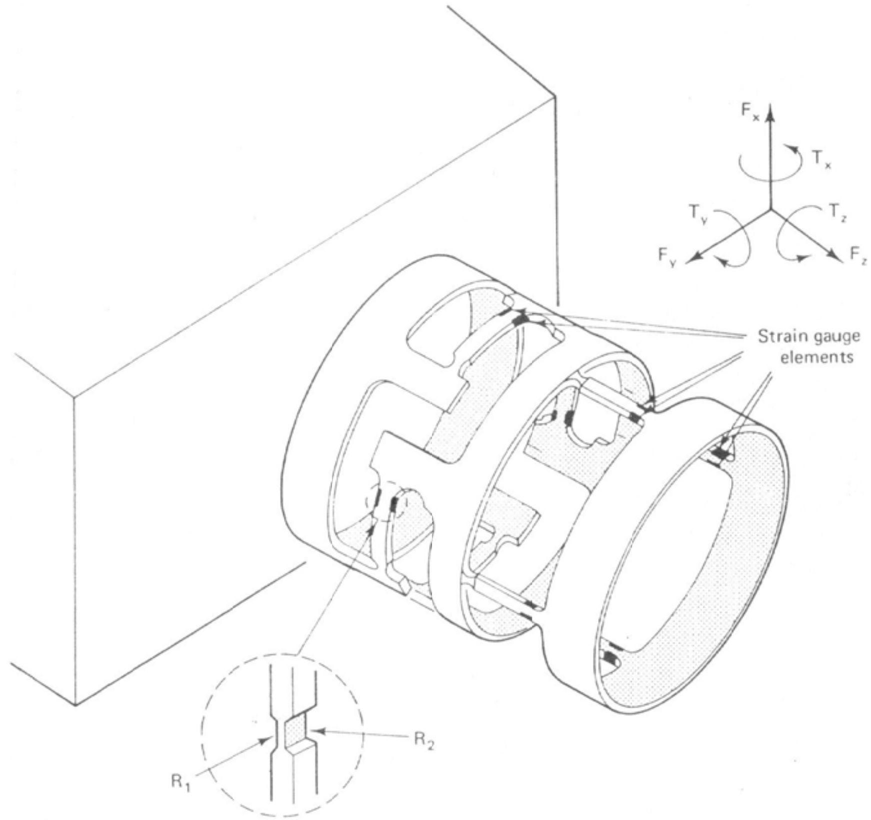
AUTOMAZIONE – IN032





Basilio Bona – Dipartimento di Automatica e Informatica – Politecnico di Torino


X
Strain gauges
Y
Z
Wrist force sensor
Deflection bars
F_x
M_x
W_1
W_2
W_3
W_4
W_5
W_6
W_7
W_8
M_y
F_y
M_z
F_z


F_x
T_x
T_y
T_z
F_y
F_z
Strain gauge elements
R_1
R_2

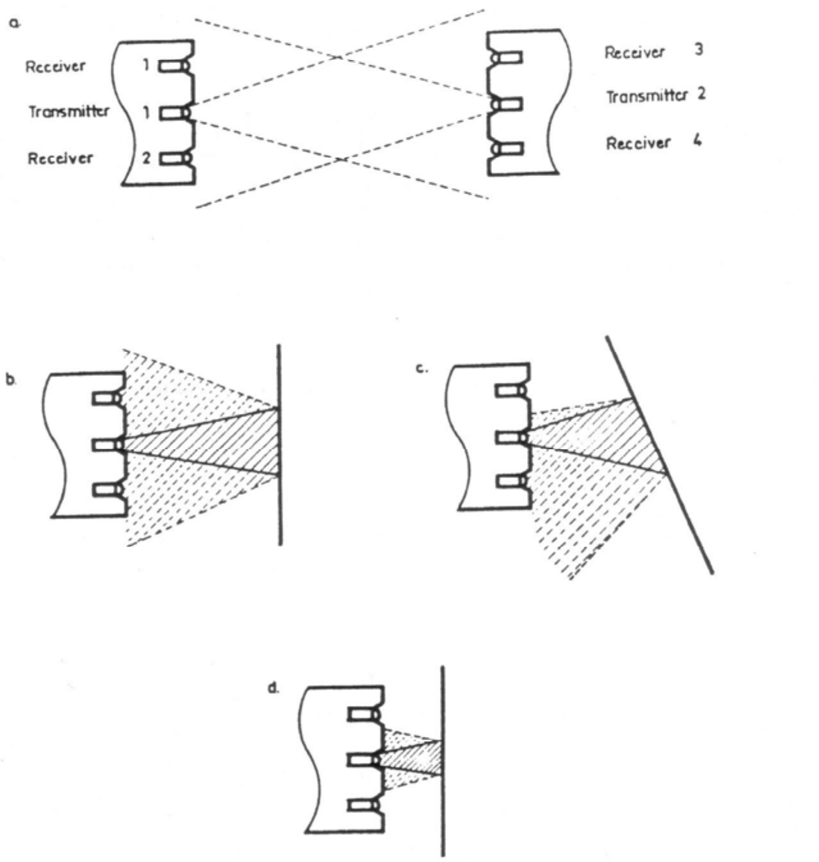


Fig. 24.22. Principle of object detection between fingers. (*a*) Configuration of infrared transmitter and receiver. (*b, c*) Reflection of signals by parallel and nonparallel object surface. (*d*) Sensor configuration for object approach.

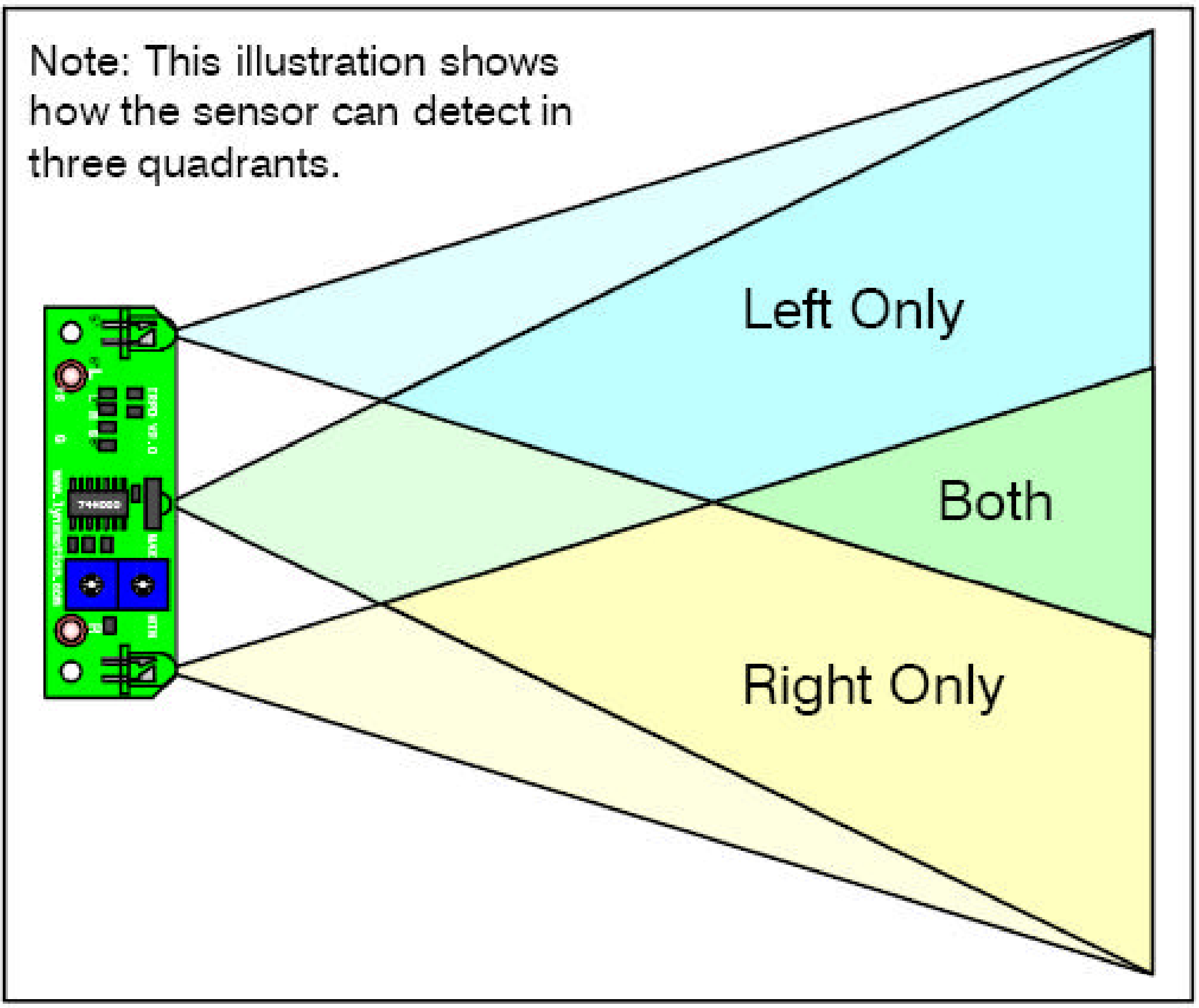
system of a robot. For the addition of a sensor or a change of a gripper, the software primitives can be reconfigured.

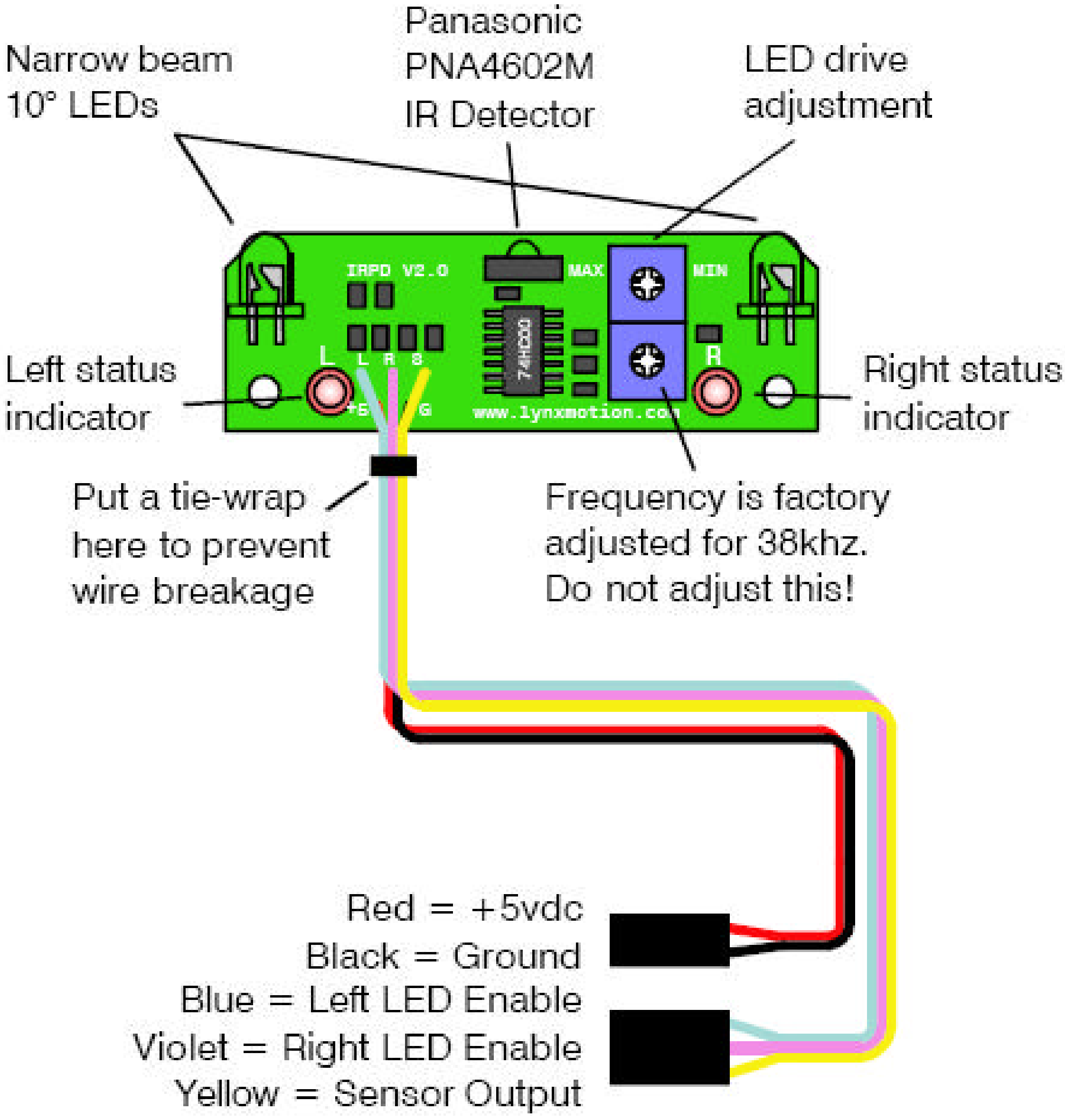
24.6.3. Laser Scanner for Distance Measurements

The three different measurement techniques used to obtain distances for industrial robots (from 10 cm to 10 m) are based on the phase shift, the time of light, and the triangulation principle. All of these use laser scanners. However, they have severe restrictions: the large dynamic range of the reflected beam (up to 100 dB), the low signal-to-noise ratio (e.g., due to photon noise), and sometimes the slow pixel scanning rate (e.g., 500 msec/pixel).

Laser scanners, which are based on phase-shift measurements (indirect time of light measurement), are described in Reference 21. Here we mention only that the maximum pixel rate that can be obtained by this kind of scanner is about 25 msec/pixel. Modern laser scanners are controlled by computers and are therefore not used as off-line devices, as was done, for example, in Reference 21.

The most ambitious approach to measuring distances is the direct measurement of the time of light. Distance and intensity data can be obtained in about 1 μsec. However, for a distance of 1 m the light time of light is 3.3 nsec. This means that a device must be used whose time resolution is 16.5 psec to get a distance resolution of 5 mm. The only technique that can meet these requirements is coincidence measurement (time spectroscopy), which is used in nuclear science and in high-energy physics. Time-to-amplitude converters (TACs) are used to measure the time relationship between a start and stop signal.[22] The timing resolution of these instruments is defined by the full width half


Note: This illustration shows
how the sensor can detect in
three quadrants.
Left Only
Both
Right Only



Narrow beam
10° LEDs
Panasonic
PNA4602M
IR Detector
LED drive
adjustment
IRPD V2.0
MAX
MIN
74HC00
L
R
Left status
indicator
Right status
indicator
www.lynxmotion.com
Put a tie-wrap
here to prevent
wire breakage
Frequency is factory
adjusted for 38khz.
Do not adjust this!
Red = +5vdc
Black = Ground
Blue = Left LED Enable
Violet = Right LED Enable
Yellow = Sensor Output