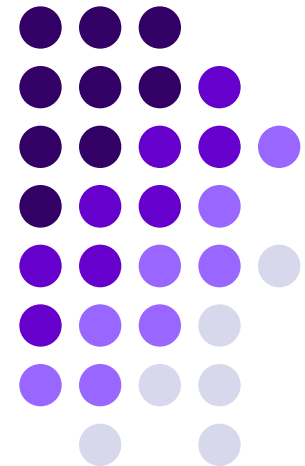
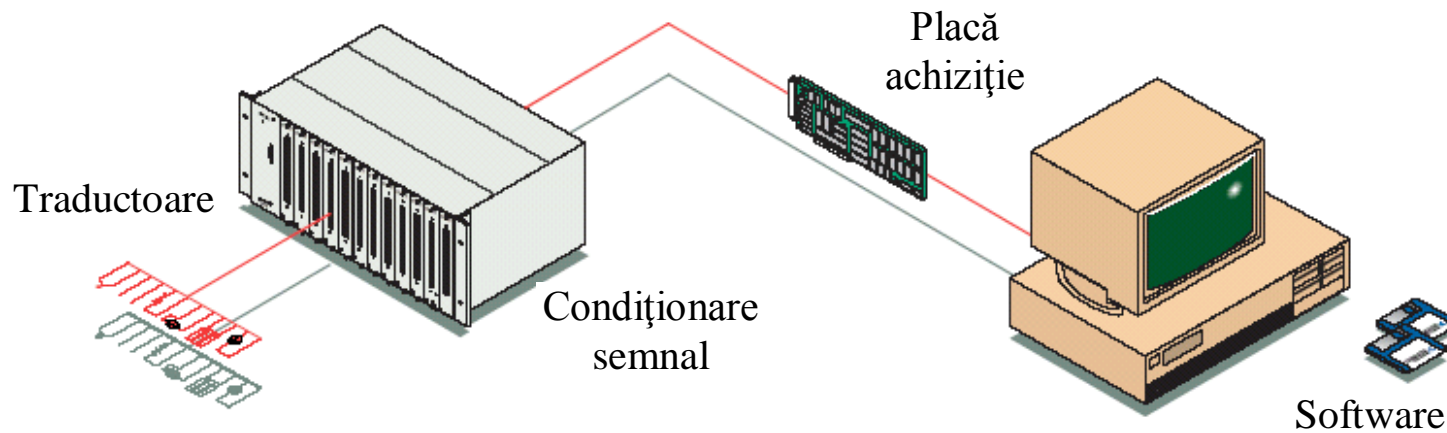
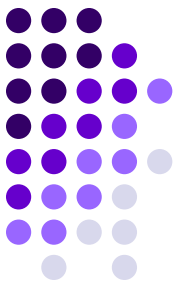


Senzori inteligenti si achizitii de date

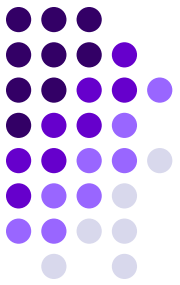




Cuprins_6

- Segmentarea imaginii
- Imagine si contur
- Extragerea conturului
- Topologia zonelor
- Codificarea imaginii
- Modelarea imaginii
- Exemplu
- Iluminarea scenei de lucru
- Concluzii

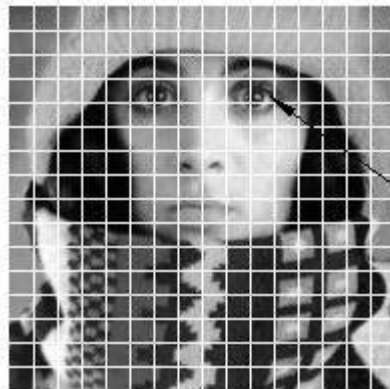
Segmentarea imaginii



- Segmentarea imaginii = operația de extragere teoretică (separare) a unor **zone particulare** din imaginea tratată anterior.
- ***Pixelii*** aparținători acestor zone au **o proprietate comună** (de ex. aparțin la obiectul vizualizat).

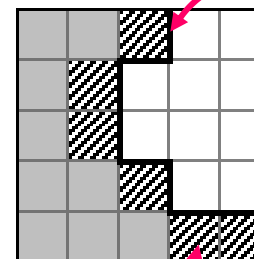
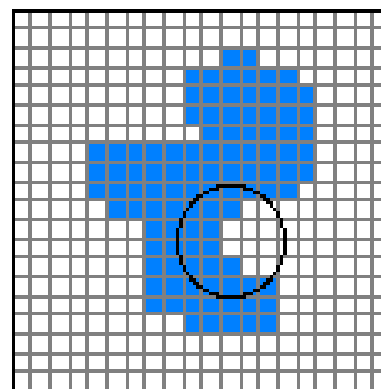
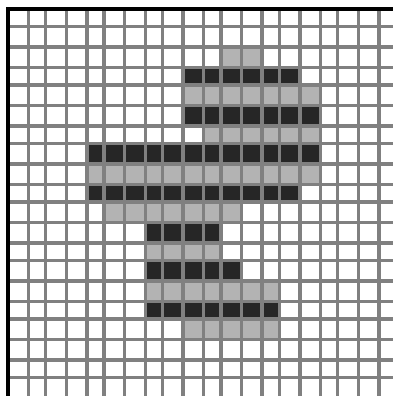
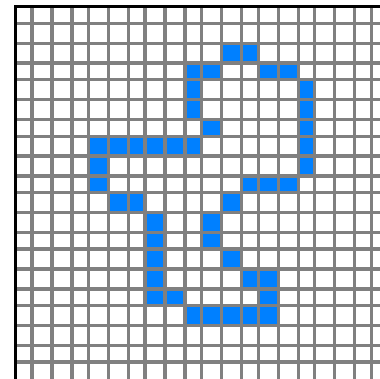
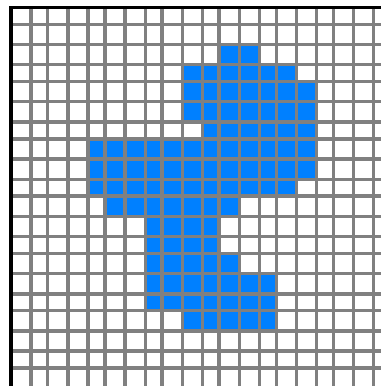
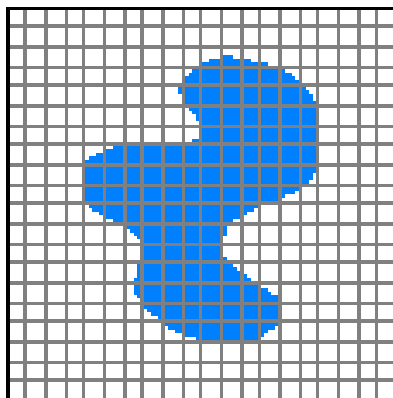
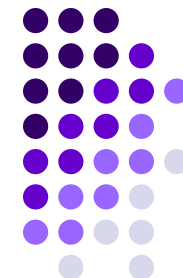
În mod curent se aplică două metode:

- a) **extragerea conturului** - se separă toți pixelii cuprinși în interiorul unor linii cu contrast puternic;
- b) **topologia zonelor** - se separă toți pixelii dintr-o zonă care respectă o aceeași stare logică.



pixel

Imagine si contur

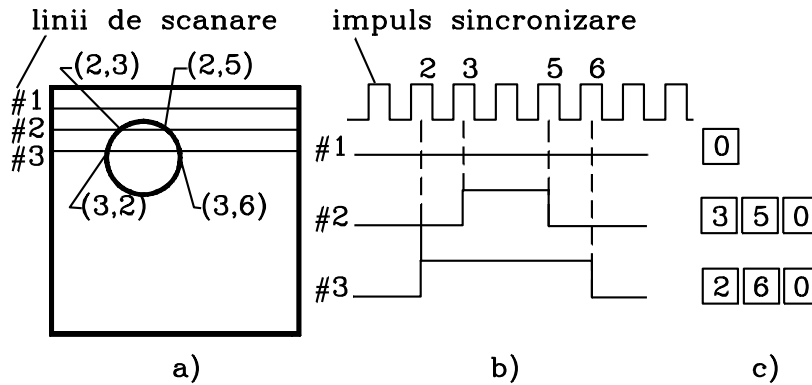
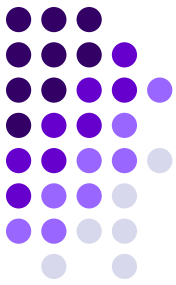


Linie
contur

Pixel de
contur

Parametrul	Simbol	Valori tipice
Linii	N	256, 512, 525, 625, 1024, 1035
Coloane	M	256 512, 768, 1024, 1320
Nivele de gri	L	2, 64, 256, 1024, 4096, 16384

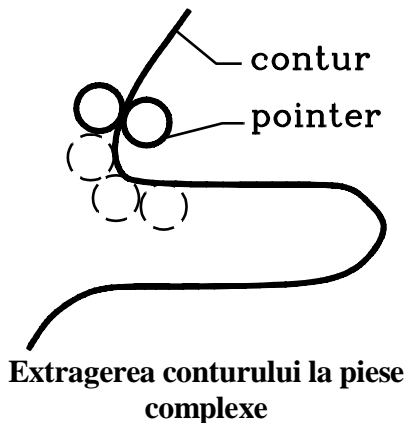
Extragerea conturului



Extragerea conturului:

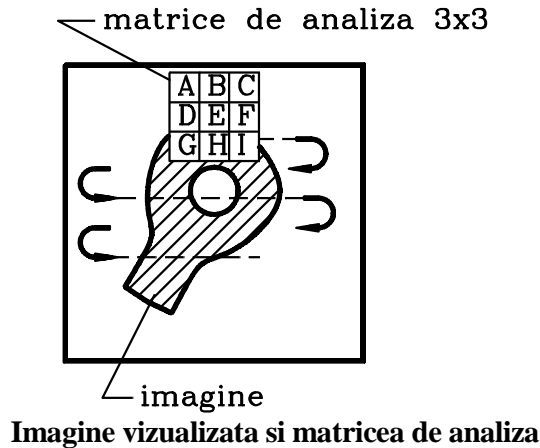
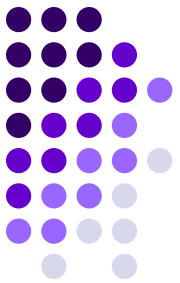
a - scanarea imaginii; b - semnal video; c - informație memorată

Extragerea conturului =
definirea limitelor imaginii
 unui obiect vizualizat în
 scopul stocării acestei
 informații în memoria
 sistemului de comandă.

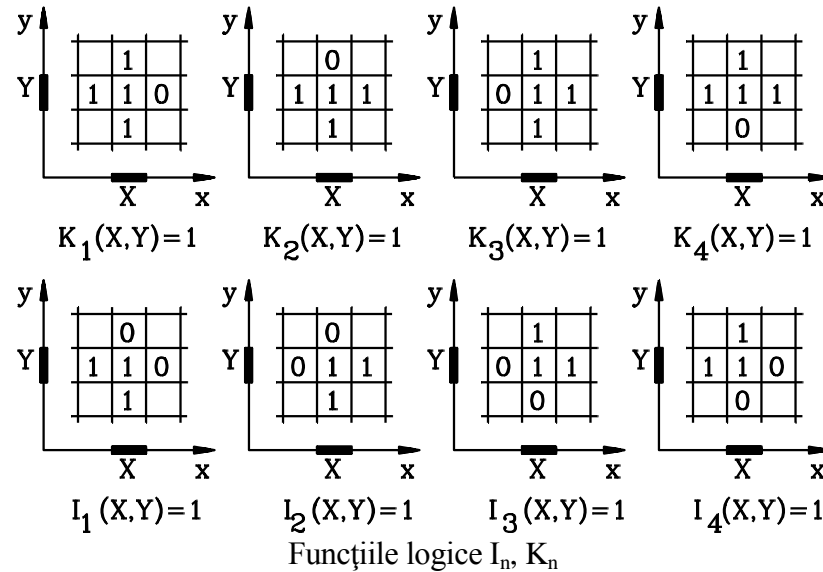


- două "zone" de control care se deplasează pe limita internă și externă a conturului teoretic;
- limita reală a conturului este descrisă de locul geometric al distanței minime dintre centrele celor două "zone".

Topologia zonelor



$$k(x, y) = \bigcup_{n=1}^4 [I_n(x, y) \cup K_n(x, y)]$$



$$a_0 \cdot \overline{a_1} \cdot \overline{a_2} \cdot \overline{a_3} \cdot \overline{a_4} = 1 \quad \longrightarrow \quad \text{urmeaza o noua zona}$$

$$a_0 \cdot a_2 = 1 \quad \longrightarrow \quad a_0 \text{ si } a_2 \text{ apartin la aceeasi zona}$$

$$a_0 \cdot \overline{a_2} = (a_1 + a_4) \cdot \overline{a_3} \quad \longrightarrow \quad a_0 \text{ apartine la zona } a_1 \text{ sau } a_4$$

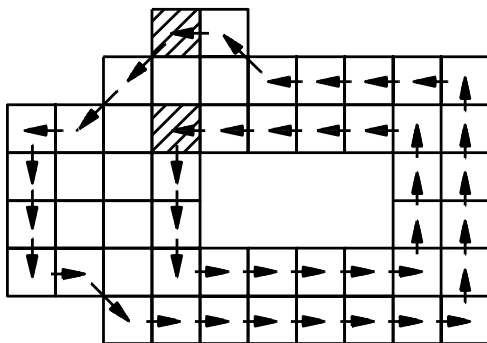
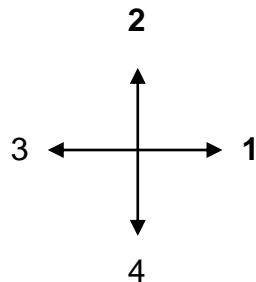
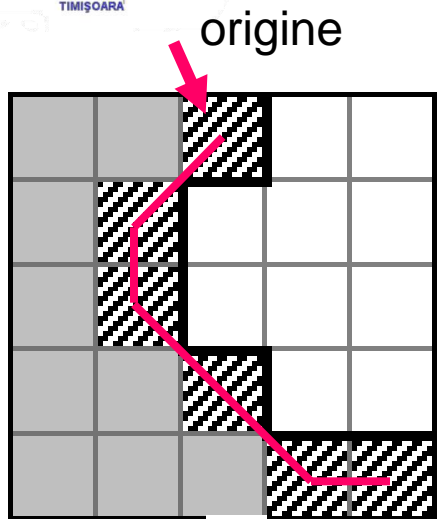
$$a_0 \cdot \overline{a_2} = (\overline{a_1} \cdot \overline{a_4}) \cdot a_3 \quad \longrightarrow \quad a_0 \text{ apartine cu } a_3$$

a_3	a_2	a_1
a_4	a_0	

Matrice de analiza

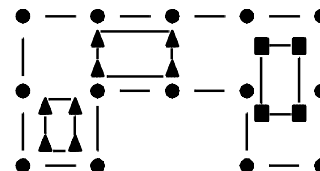
Codificarea imaginii

Sens de parcurgere



4	3	2
5	*	1
6	7	8

a)



b)

Exemplu de codificare:

a) – codul Freeman; b) - contururi tratate

Cod : 6 7 8 8 1

Cod contur: 4 3 4 4 1 4 1 1

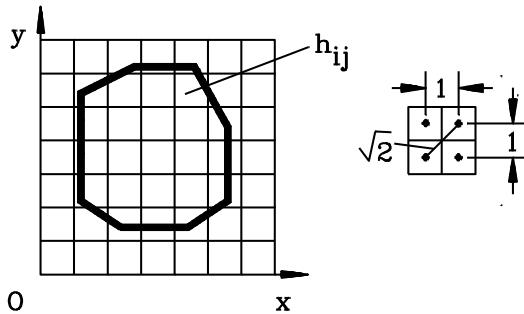
-contur exterior:

66577718111111133333555545

-contur interior:

7771111133355555

Modelarea imaginii



$$h_{ij} = \begin{cases} 1, & \text{daca } (i, j) \in \text{obiect} \\ 0, & \text{daca } (i, j) \notin \text{obiect} \end{cases}$$

Determinarea parametrilor geometrici ai imaginii

Aria imaginii vizualizate:

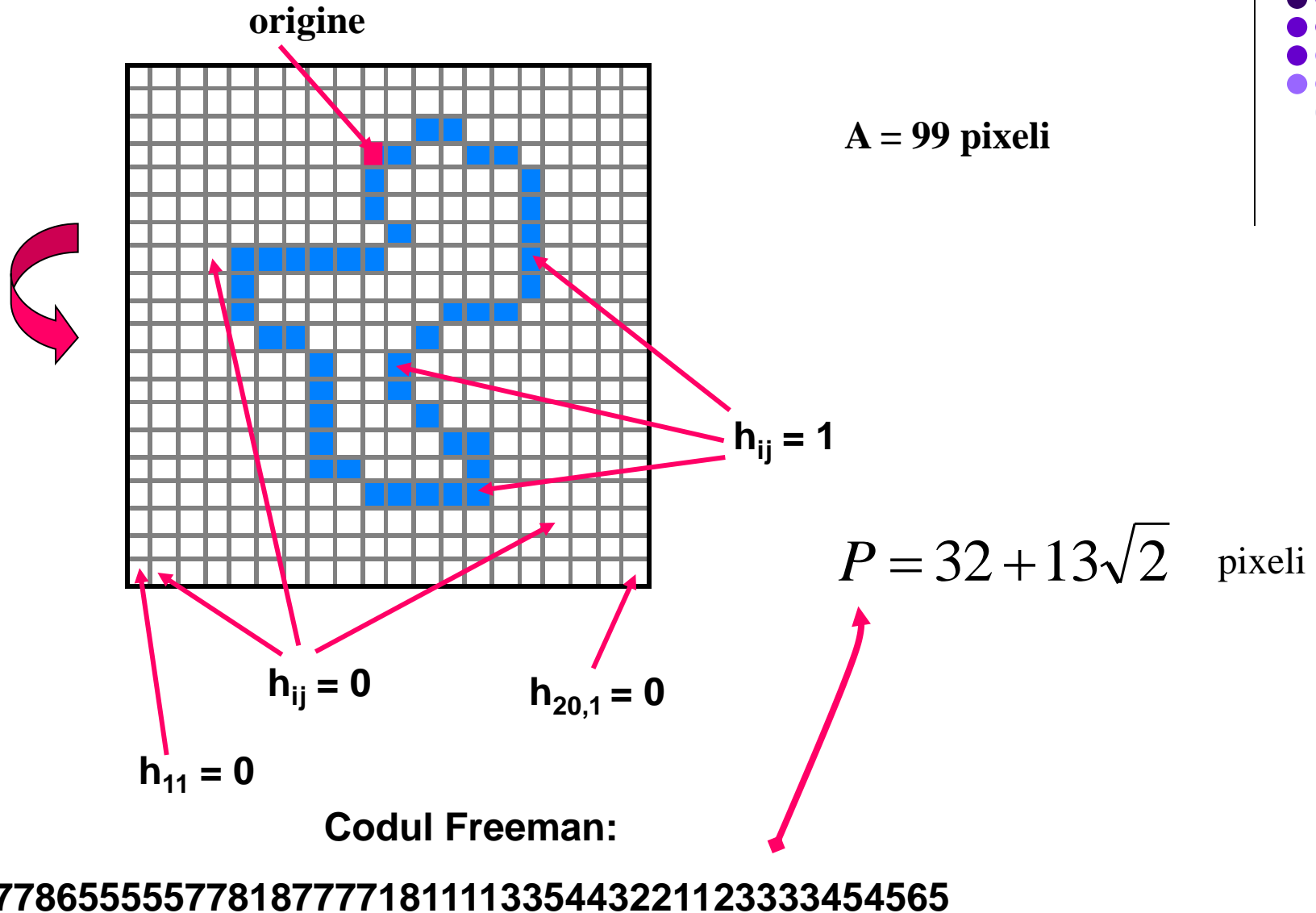
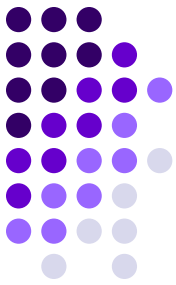
$$A = \sum_{i=0}^{n-1} \left(\sum_{j=0}^{n-1} h_{ij} \right)$$

Perimetrul conturului (Γ) al imaginii:

$$P = \sum_{(\Gamma)} m' \quad \text{unde } m' = \begin{cases} 1, & \text{daca } m \text{ este numar impar} \\ \sqrt{2}, & \text{daca } m \text{ este numar par} \end{cases}$$

m = cifra din codul Freeman

Exemplu



Coordonatele centrului de greutate (X_s , Y_s) al suprafeței delimitate de contur :

$$X_s = \frac{1}{A} \cdot \sum_{j=0}^{n-1} \left(\sum_{i=0}^{n-1} i \cdot h_{ij} \right)$$

$$Y_s = \frac{1}{A} \cdot \sum_{i=0}^{n-1} \left(\sum_{j=0}^{n-1} j \cdot h_{ij} \right)$$

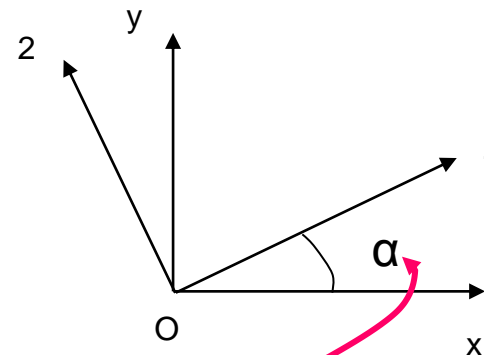
Momentele de inerție axiale ale suprafeței (față de axele Ox , Oy) și momentul de inerție centrifugal:

$$J_x = \sum_{i=0}^{n-1} i^2 \left(\sum_{j=0}^{n-1} h_{ij} \right)$$

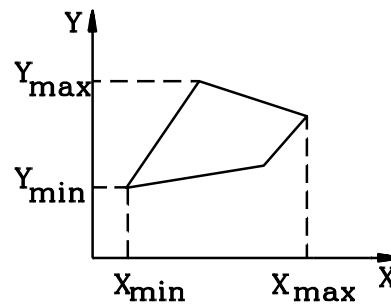
$$J_{xy} = \sum_{i=0}^{n-1} i \left(\sum_{j=0}^{n-1} j \cdot h_{ij} \right)$$

$$J_y = \sum_{j=0}^{n-1} j^2 \left(\sum_{i=0}^{n-1} h_{ij} \right)$$

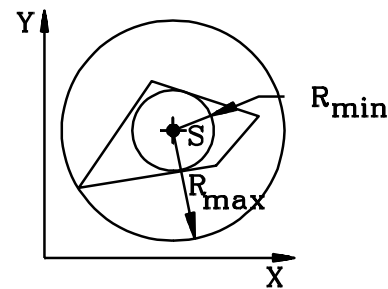
$$J_{1,2} = \frac{1}{2} \cdot (J_x + J_y) \pm \sqrt{\frac{1}{4} \cdot (J_x - J_y)^2 + J_{xy}^2}$$



$$\alpha = \frac{1}{2} \cdot \arctg \left(\frac{2 J_{xy}}{J_y - J_x} \right)$$



a)

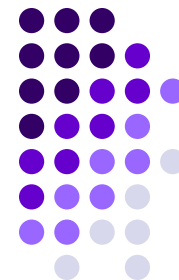


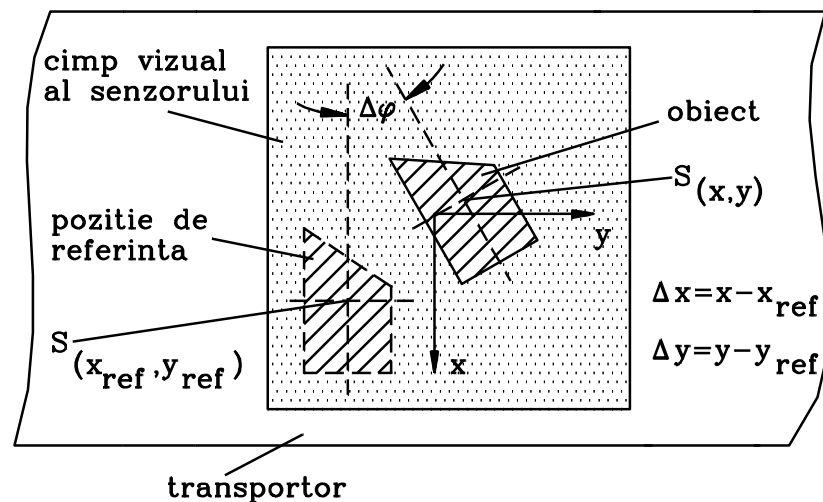
b)

Parametrii caracteristici (poligon circumscris, raze)

Opțional se mai pot calcula:

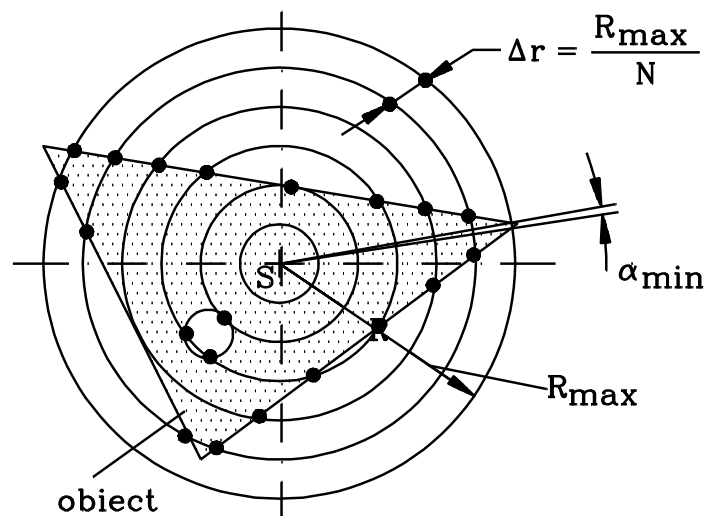
- raportul Y_{\max} / X_{\max} dintre dimensiunile de gabarit pe direcție verticală și orizontală;
- complexitatea conturului X_{\max}/P ;
- compactitatea figurii: $A/(X_{\max} Y_{\max})$;
- simetria X_S/X_{\max} , Y_S/Y_{\max} .





Operația de determinare a unor parametri

a) măsurări independente de piesa vizualizată (aria, perimetrul etc);



Măsurări independente de piesă

- cercuri echidistante;

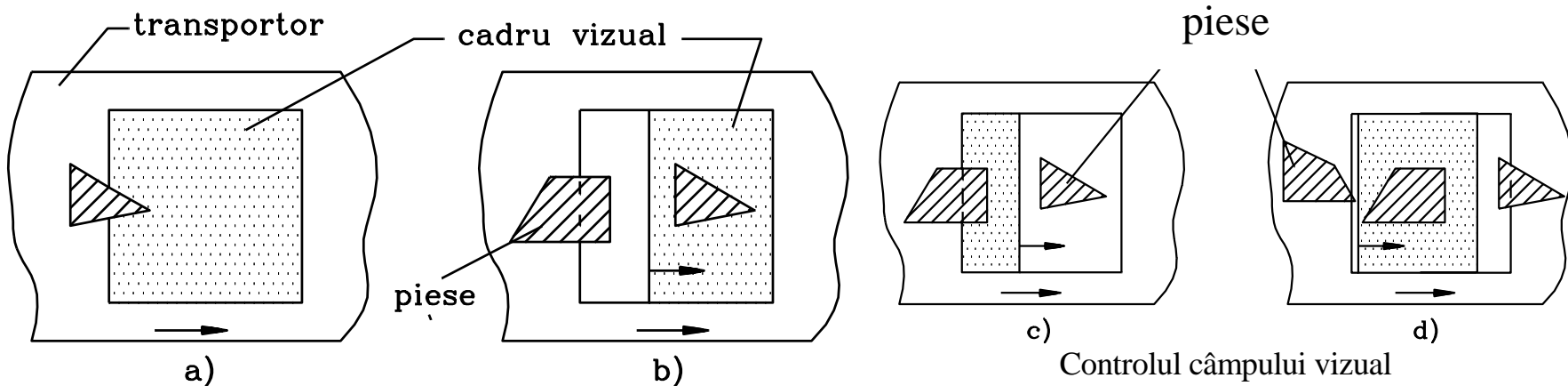
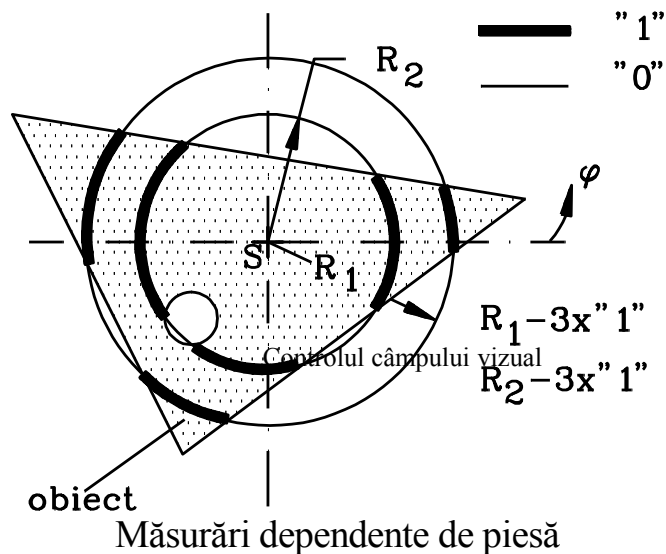
- parametri:

- ❖ numărul segmentelor de intersecție ale conturului cu cercurile de explorare,

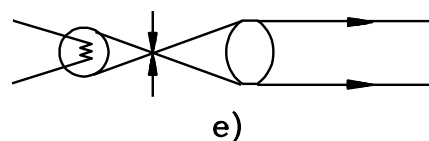
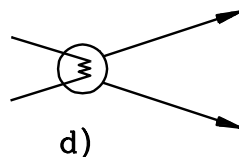
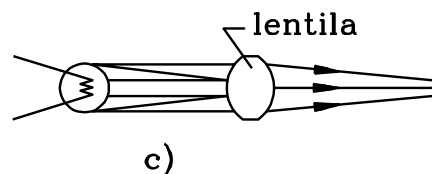
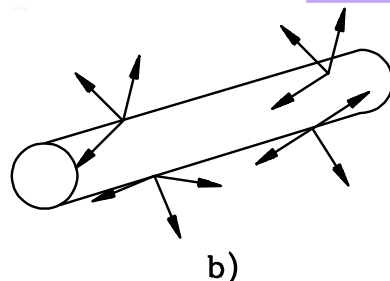
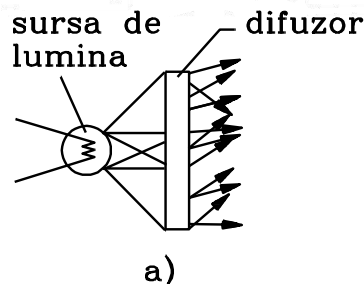
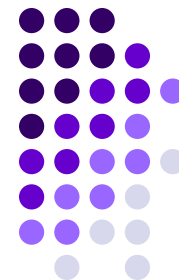
- ❖ unghiul α_{min} pentru raza maximă.

b) Măsurări dependente de piesa vizualizată

- funcții înregistrate pe cercul de rază R_1 , $R_2 - 3 \times "1"$
- corelația dintre unghiul Φ și raza R .



Iluminarea scenei de lucru



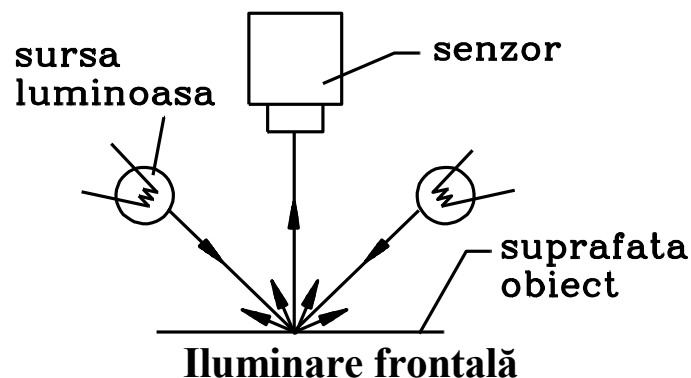
Corpuri de iluminat

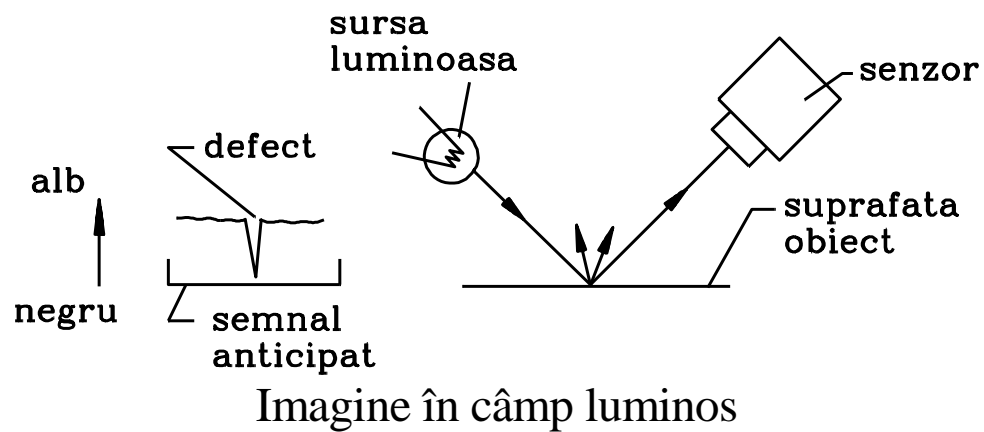
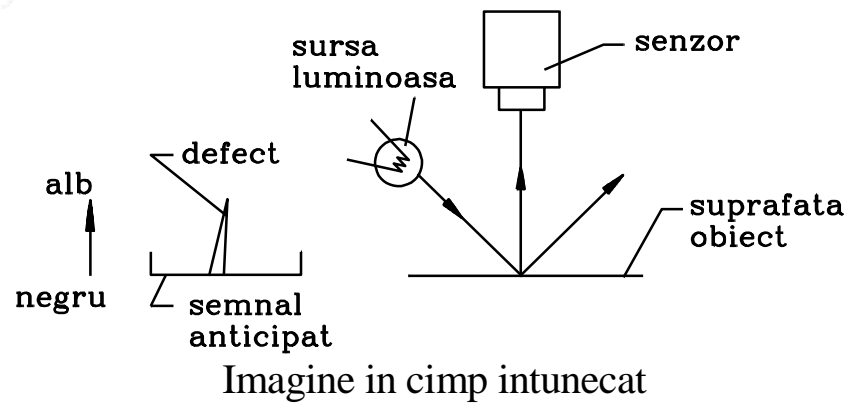
- suprafețe difuze (a) (lămpi fluorescente - b, reflectoare difuze);

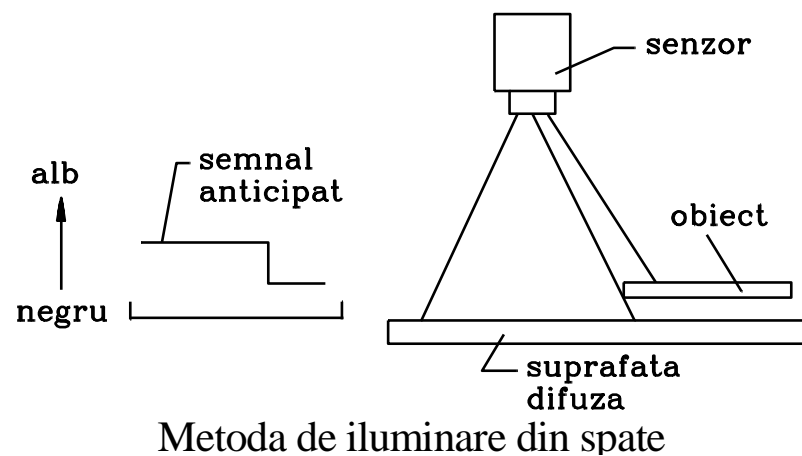
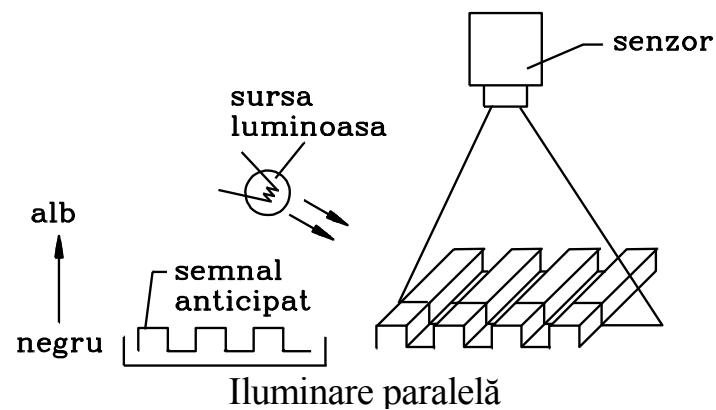
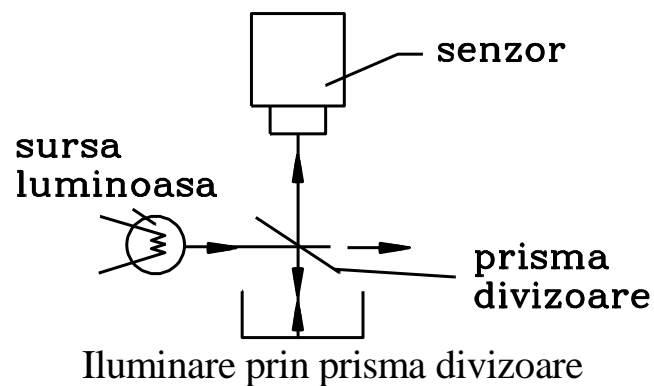
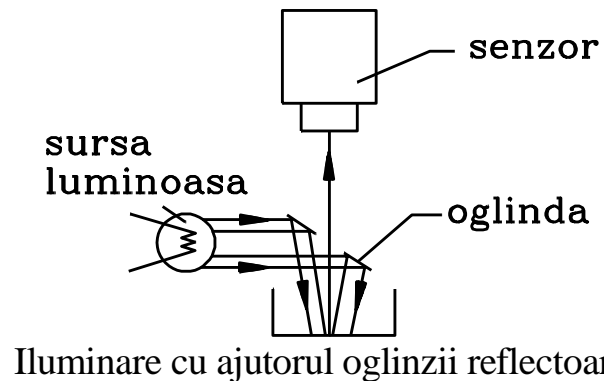
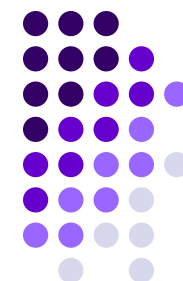
- condensoare (c),

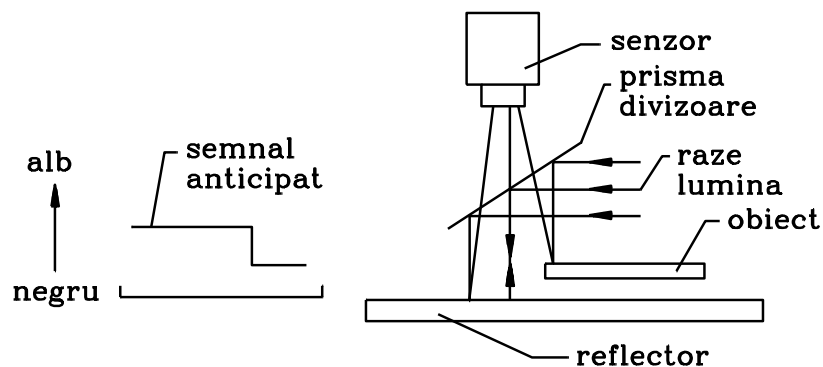
- proiectoare (d);

- colimatoare (e).

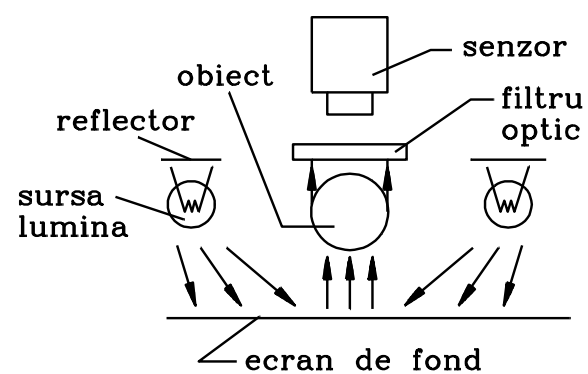




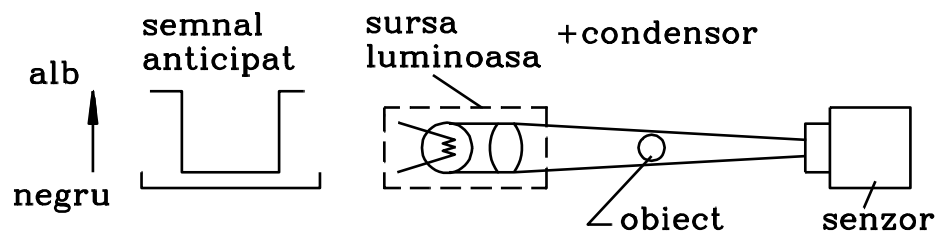




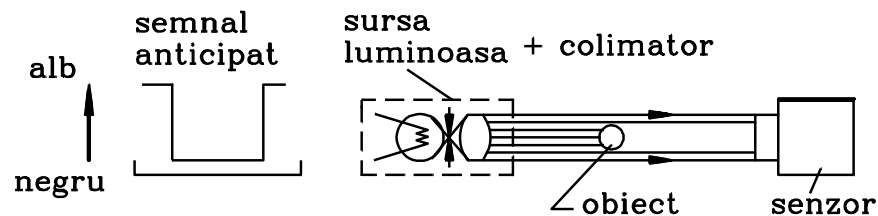
Utilizarea unei suprafețe reflectorizante



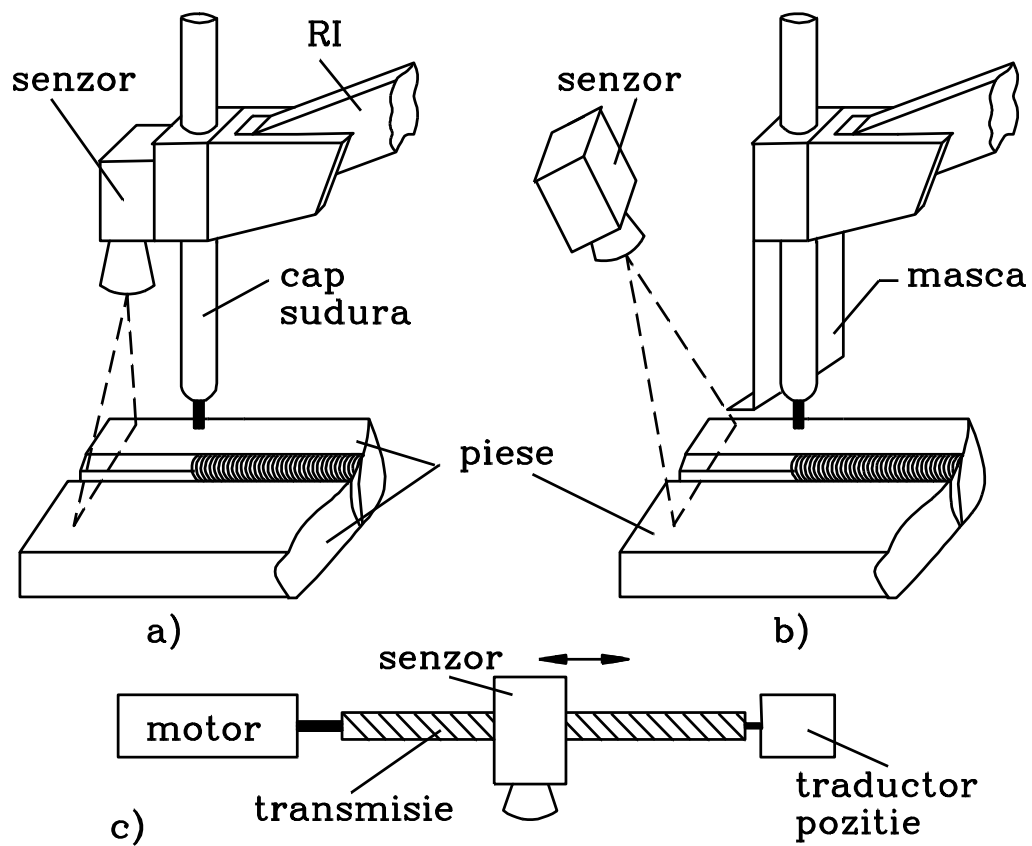
Illuminare monocromatică



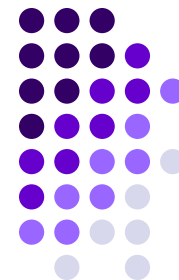
Utilizarea condensatorului

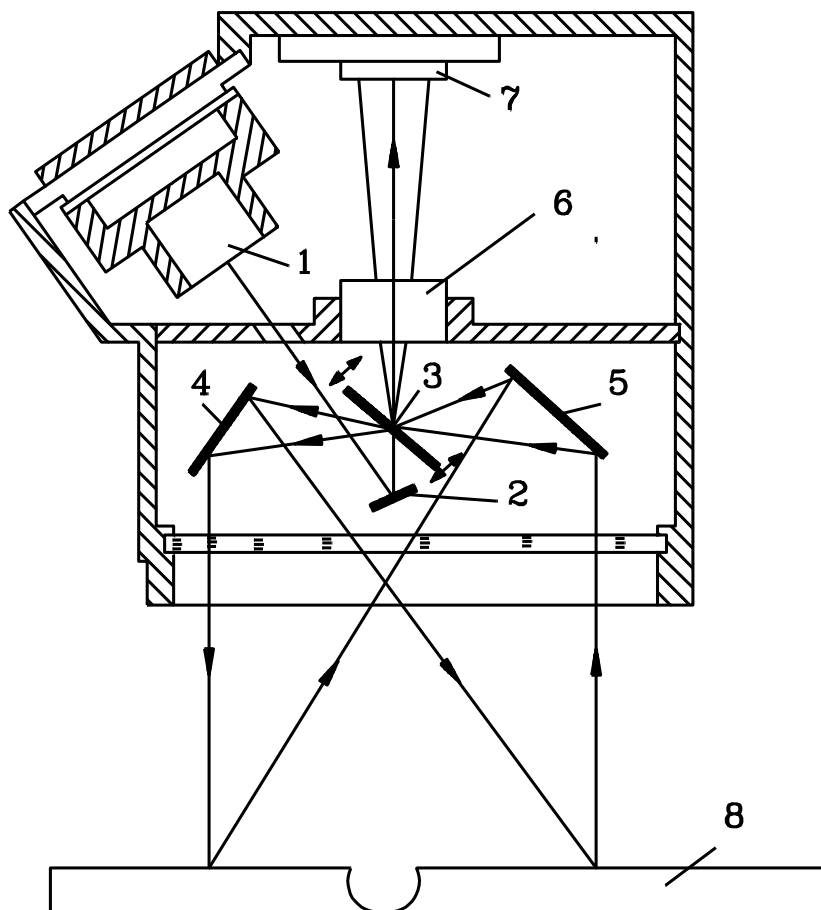
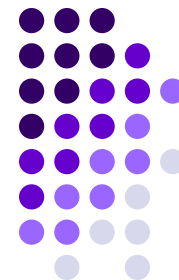


Utilizarea colimatorului



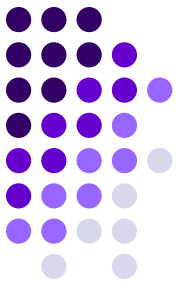
Poziționarea senzorului vizual





Sursa de lumină și senzorul vizual în structură compactă

- 1- sursa lumina;
- 2 , 3, 4, 5 – oglinzi;
- 6 – filtru optic
- 7 – senzor video CCD
- 8 – piesa pentru sudat



Cerințe principale pentru un senzor vizual:

- simplitate în deservire;
- viteză mare de prelucrare a informației;
- flexibilitate, posibilitate de adaptare la diferite sarcini (de ex. regim de bandă rulantă, descărcarea paletelor, controlul pieselor etc.);
- sensibilitate geometrică cât mai mare;
- cost redus;
- posibilități simple de conectare în cadrul sistemului;
- siguranță ridicată în funcționare;
- sensibilitate redusă la factori perturbatori.