

( )

## جداسازی مواد معدنی به روش الکتروستاتیکی

( )

( )

/ /

/

## **Minerals Separation by Electrostatic Method**

**E. Borzabadi and M. Bakhshi Zade Mahmoodi**

**Department of Physics, University of Isfahan**

### **Abstract**

Electrostatic separation (induction & contact charging) of minerals (conductors and insulators) was investigated experimentally. The results showed that if a mixture of insulator materials of 0.2 to 0.4 mm size contacted with each other, different materials acquired different charges and when they fall in an electrical or gravitational field, they separate from each other. The charge that different materials acquired was in agreement with other's finding. Separation of conductors was not effective by contact charging but was feasible with induction method. The experiment showed that the time of contact had an appreciable role in separation, but the type of metal had no effective role in separation. Separation of particles less than 0.1 mm size was not effective due to their coagulation. Humidity prevented charging and separating of materials, the process was better in dry condition.

**Keywords:** Separation of minerals, Electrostatic separation

/...

/

/ .(.)  
(.)

( )  
)

( ) . (

(.) (FeTio)

:

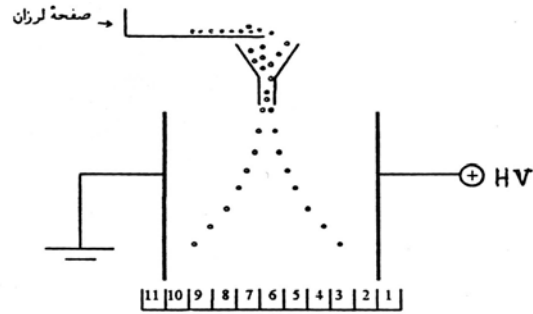
/

( )

( )

( )

/...



:( )

$$x = \frac{1}{2} \frac{qE}{m} t^2$$

t.

t

m q

g)

$$y = \frac{1}{2} g t^2$$

y

(.

× V/m

E

Fe

E

r

Fg

$$F_e / F_g = \frac{3\delta E}{r\rho g}$$

g

$\rho$

$$\delta = \epsilon_0 E$$

%

E %

$\delta$

/

$$Fe / Fg = \frac{1}{r\rho}$$

$$3g / cm^3$$

$$Fe / Fg = \frac{1}{3}$$

$$1mm$$

$$20\mu m \quad 20\mu m$$

$$10^5 V / m \quad . ( )$$

( )

:

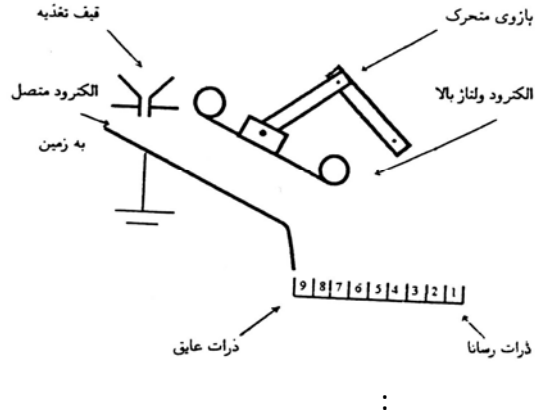
$$t_m > t_E \quad ( ) t_E \quad t_m$$

$$t_E \quad t_m < t_E$$

$$: \quad \in \quad \rho$$

$$t_E = \rho \varepsilon$$

/...



1ms

$10^8 \Omega.m$

r m

$\alpha$

$$E = 0.241 \left(\frac{1}{r}\right) [(mg / \epsilon_0) \cos \alpha]^{1/2}$$

(.)

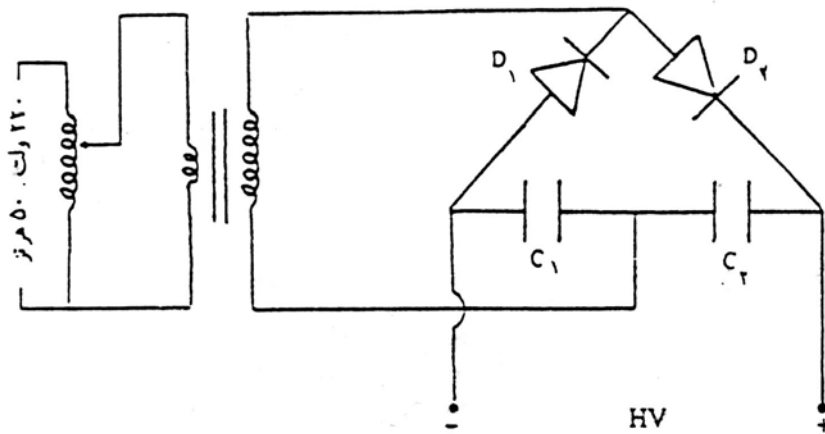
dc

10cm × 15cm

20cm × 30cm

10cm

/ 1cm



dc

15kV

10cm

dc

dc

× V/m

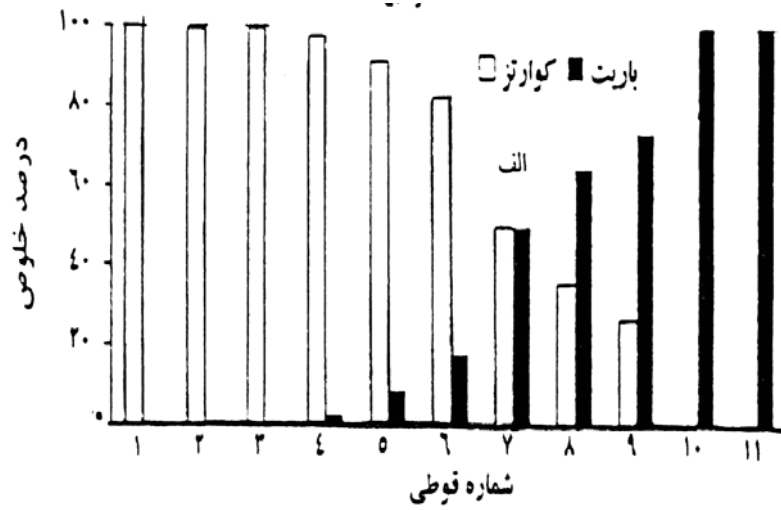
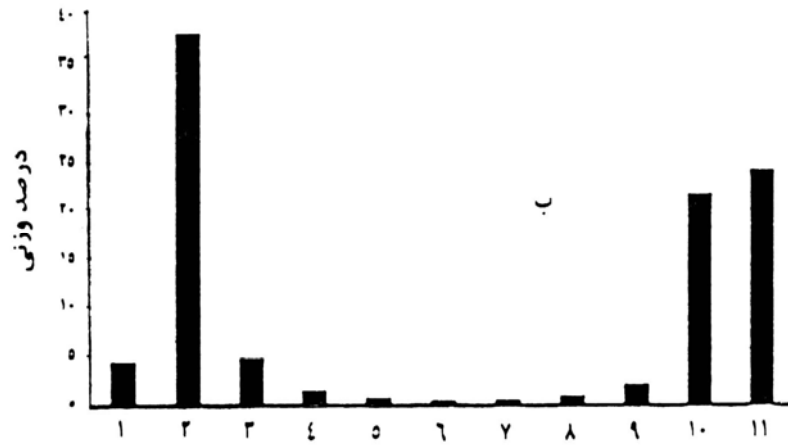


$l \dots$

$l \quad l$

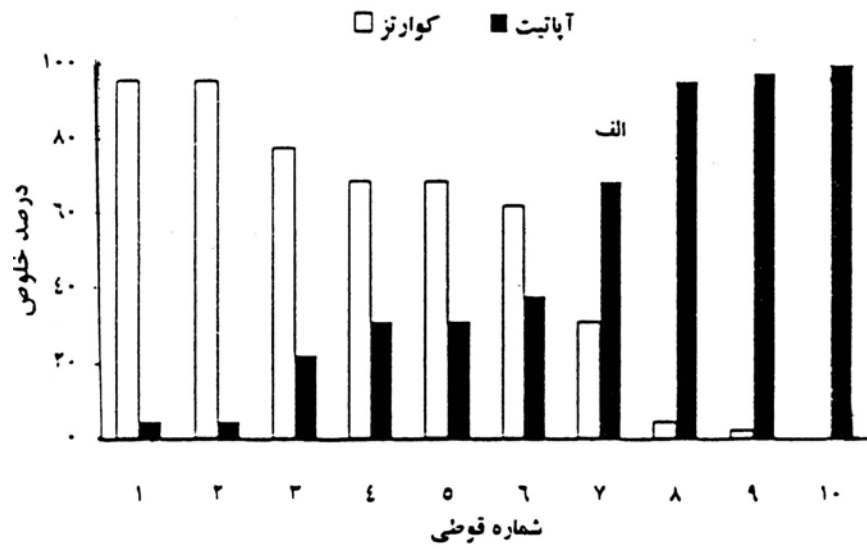
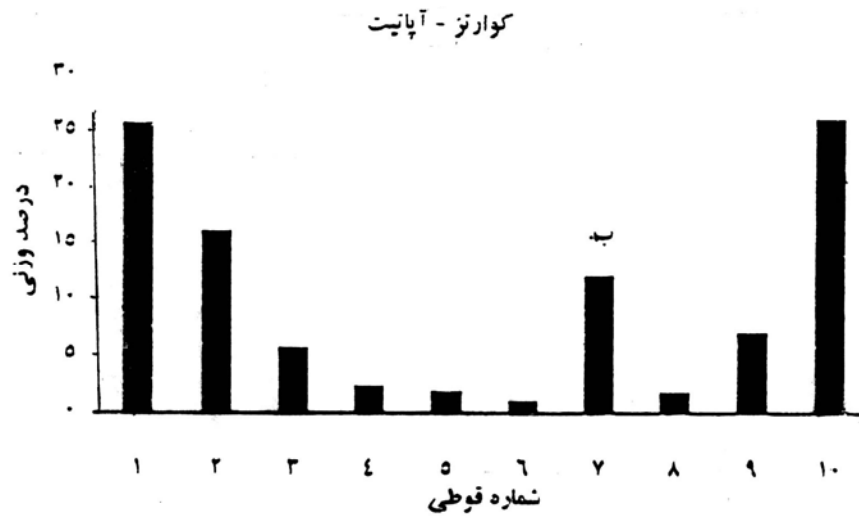
$\circ c$

$( \quad )$



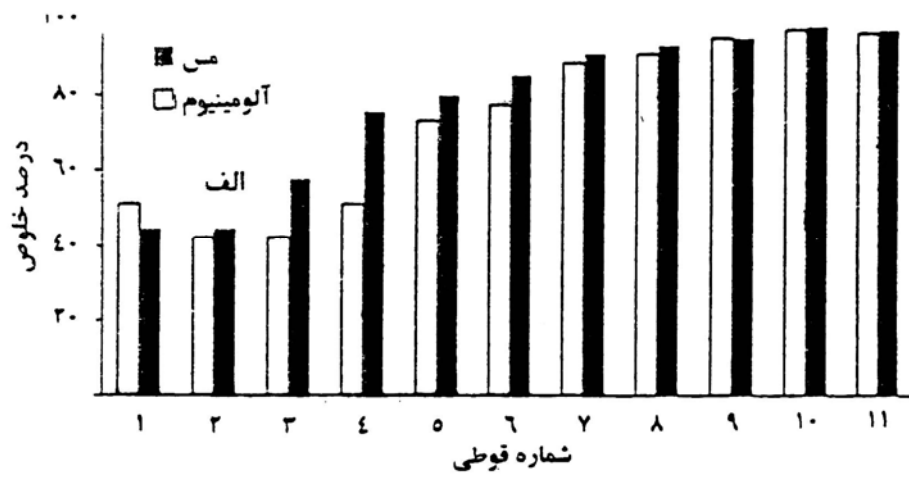
(SiO) (BaSO) :

/...



Ca (PO)

:



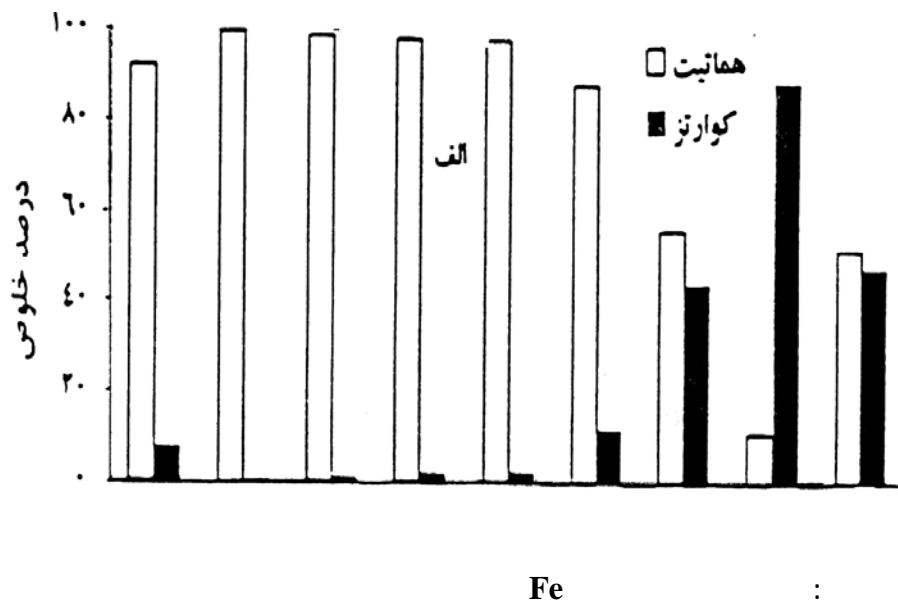
(Fe O , Fe O )

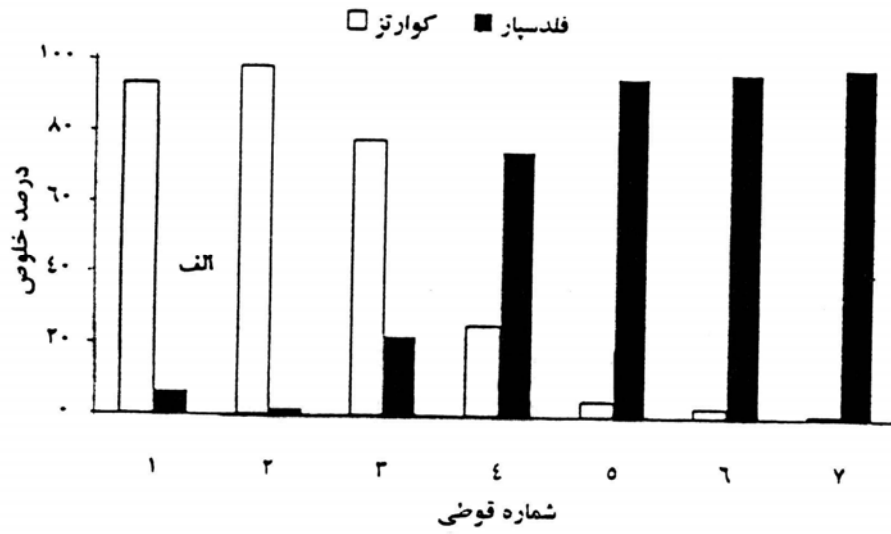
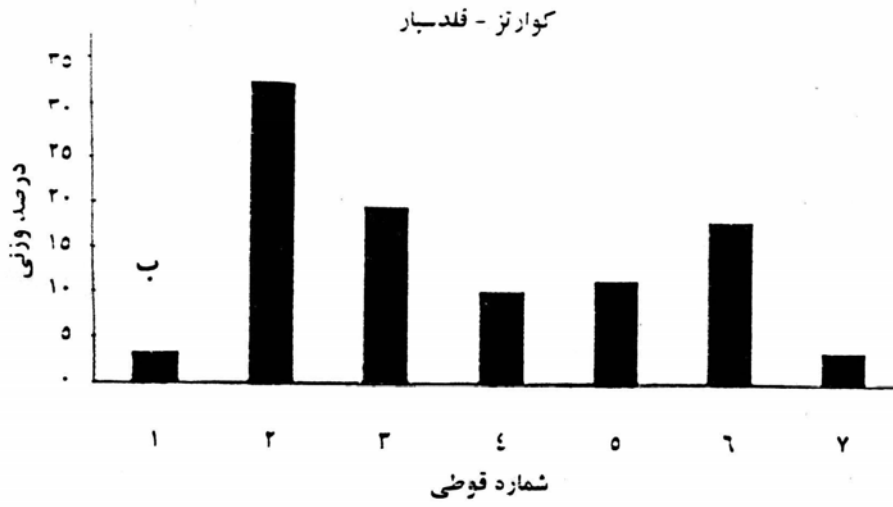
:

12cm × 20cm

( )

...



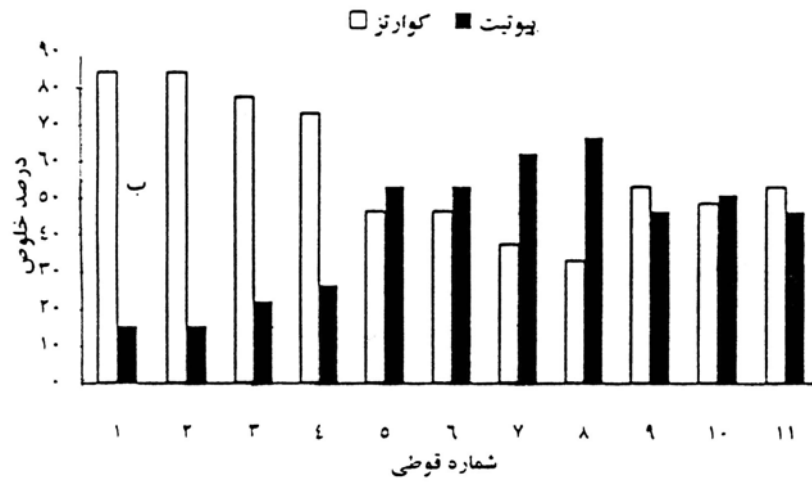
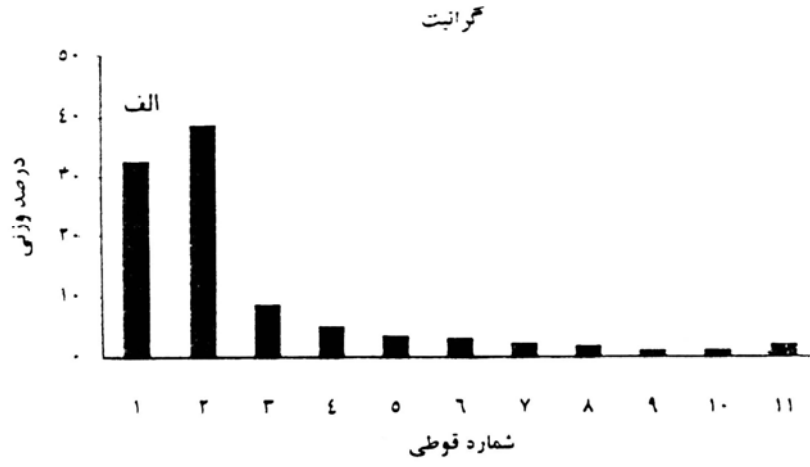


Al (Si O ) (OH) :

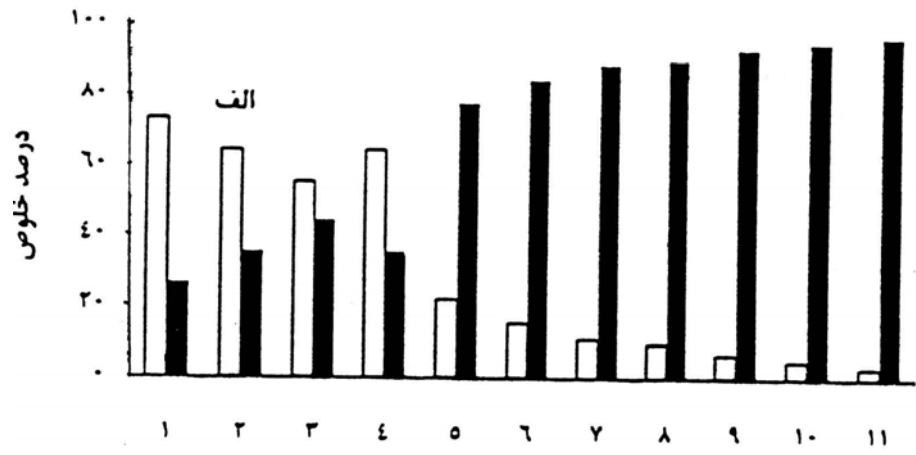
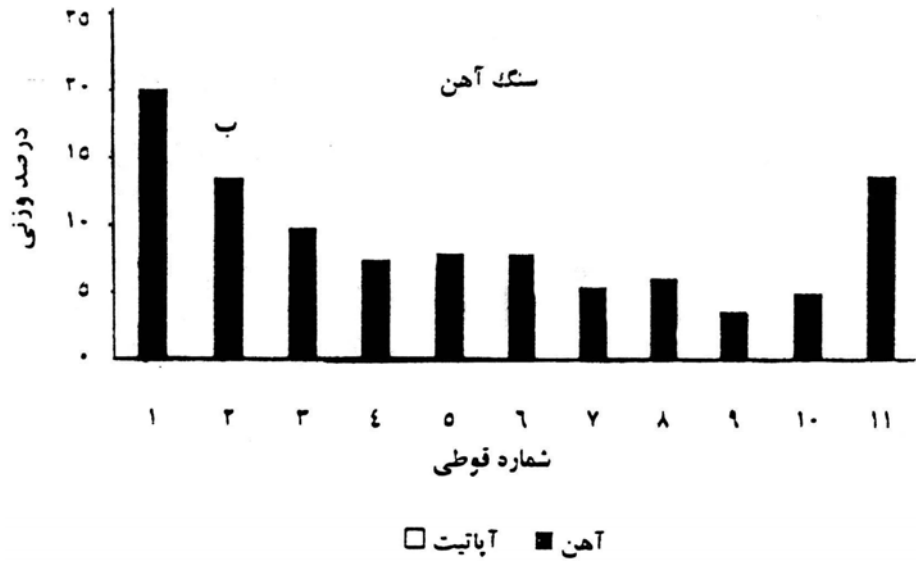
( )

( )

/...



:

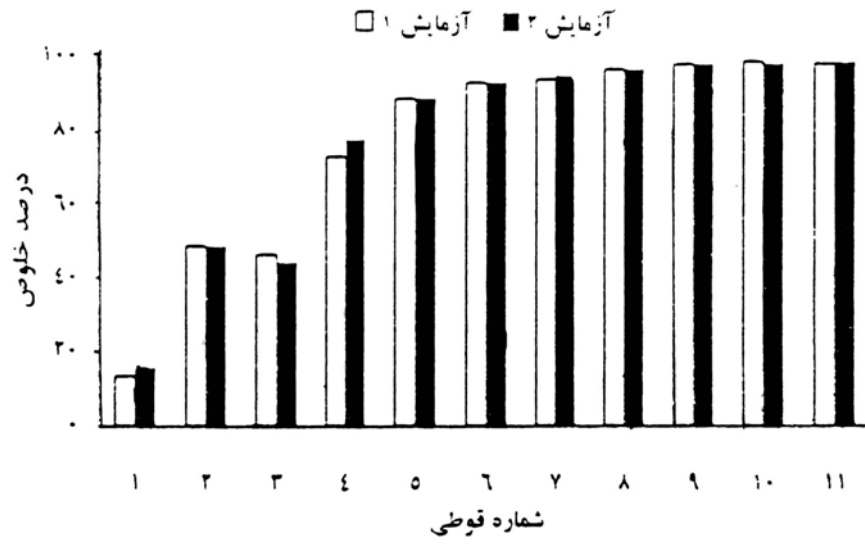


( )

:



/...



:

:

( )

( )

( ) ( )

( )

( )

( )

( )

.

 $4.2eV$   $4.4eV$ 

(... )

- . T. B. Osborne, U.S. Patent , ( ) .
- . T. A. Edison, U.S. Patent, , ( ) .
- . A. D. Moore, "Ekelectrostatics and its Applications", Wiley Interscience Publication, ( ) .
- . T. X. Li, H. Ban, J. C. Hower, J. M. Stencil, K. Sario, "Dry Triboelectrostatic Separation of Mineral Particles: A Potential Application in Space Exploration", J. lectrostatics, , ( ) .
- . A. Y. H. Cho, "Contact Charging of Micron-Sized Particles in Intense Electric Fields", J. Appl. Phys., , ( ) .

/...

- .L. Dascalescu, " Modeling of Conductive Particle Behavior in Insulating Fluids Affected by DC Electric Fields", IEEE, Trans. Indus. Appl., Vol. , No. ,( ), .
- .S. Vlad, M. Michaela Micailescu, "Numerical Analysis of Electric Field in Plate-Type Electrostatic Separators", J. Electrostatics, ,( ).
- . J. A Cross, "Electrostatics: Principles, Problems and Applications", Bristol: Adam Hilger, ( ).
- . P. Girdinio, P.Molfion. Numerical Computation of Fields in Electrostatic Devices, IEEE Trans. Ind, Appl. ( ) .