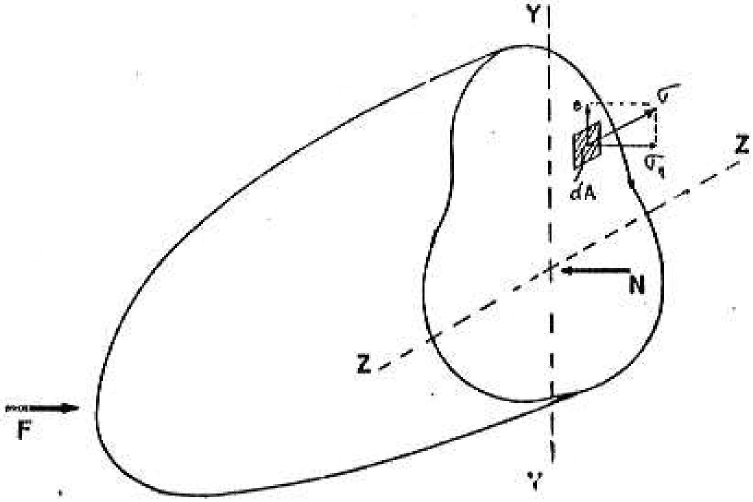
Piezas cargadas axialmente

Clase 4

Tensiones: Sección Recta, Problemas Principales, Concentración de Tensiones, Aplastamiento, Tensiones en planos oblicuos

FUERZAS CENTRALES NORMALES



$\Sigma X = 0 \quad F = N$

$\Sigma Y = 0 \quad Q_1 = 0$

$\Sigma Z = 0 \quad Q_2 = 0$

$\Sigma M_z = 0 \quad M_z = 0$

$\Sigma M_y = 0 \quad M_y = 0$

$\Sigma M_x = 0 \quad M_x = 0$

1er PASO:

a) $df_i = \sigma dA$

$dq_1 = \tau dA$

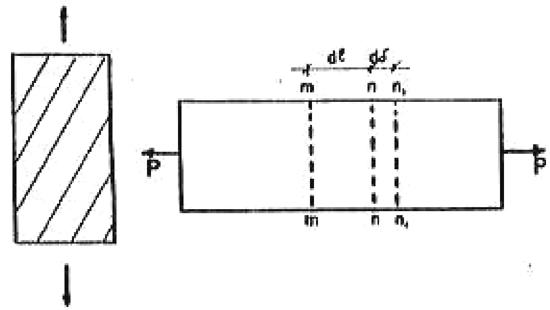
b) $\int df_i = \int \sigma dA = N$ $\quad \int y df_i = \int \sigma y dA = 0$

$\int dq_1 = \int \tau_1 dA = 0$ $\quad \int z df_i = \int \sigma z dA = 0$

$\int dq_2 = \int \tau_2 dA = 0$ $\quad \int \rho dq = \int \tau \rho dA = 0$

2do PASO

a)



$$\varepsilon = \frac{d\delta}{d\ell} = \text{CTE}$$

$$\mu = 0$$

b)

$$\sigma = f(\varepsilon) \;\ldots\ldots\; \sigma = \varepsilon E$$

$$\tau = f(\mu) \;\ldots\ldots\; \tau = G\mu$$

c) $\sigma = \varepsilon E = \text{CONSTANTE}$ $\qquad \tau = 0$

d)

$$\int \sigma \, dA = N \qquad \int \sigma y \, dA = 0$$

$$\int \tau_1 \, dA = 0 \qquad \int \sigma z \, dA = 0$$

$$\int \tau_2 \, dA = 0 \qquad \int \tau \rho \, dA = 0$$

3er PASO

a)

$$\sigma \int dA = N \qquad \sigma \int y \, dA = 0 = \sigma y_c \int dA = 0$$

$$\boxed{\sigma = \frac{N}{A}} \qquad \sigma \int z \, dA = 0 = \sigma z_c \int dA = 0$$

LIMITACIONES DE LA FORMULA $\sigma = \frac{N}{A}$

a) PARA QUE LAS DEFORMACIONES SEAN IGUALES

1. LA PIEZA DEBE SER RECTA Y TENER FORMA DE BARRA

2. LA CARGA DEBE SER AXIL Y CENTRICA

3. LA PIEZA DEBE SER DE SECCION CONSTANTE

4. LA FORMULA NO ES VALIDA EN LA CERCANIA DE LA ZONA DE APLICACION DE LAS CARGAS

b) PARA QUE $\sigma = E\epsilon$

5. LA PIEZA DEBE SER DE UN SOLO MATERIAL

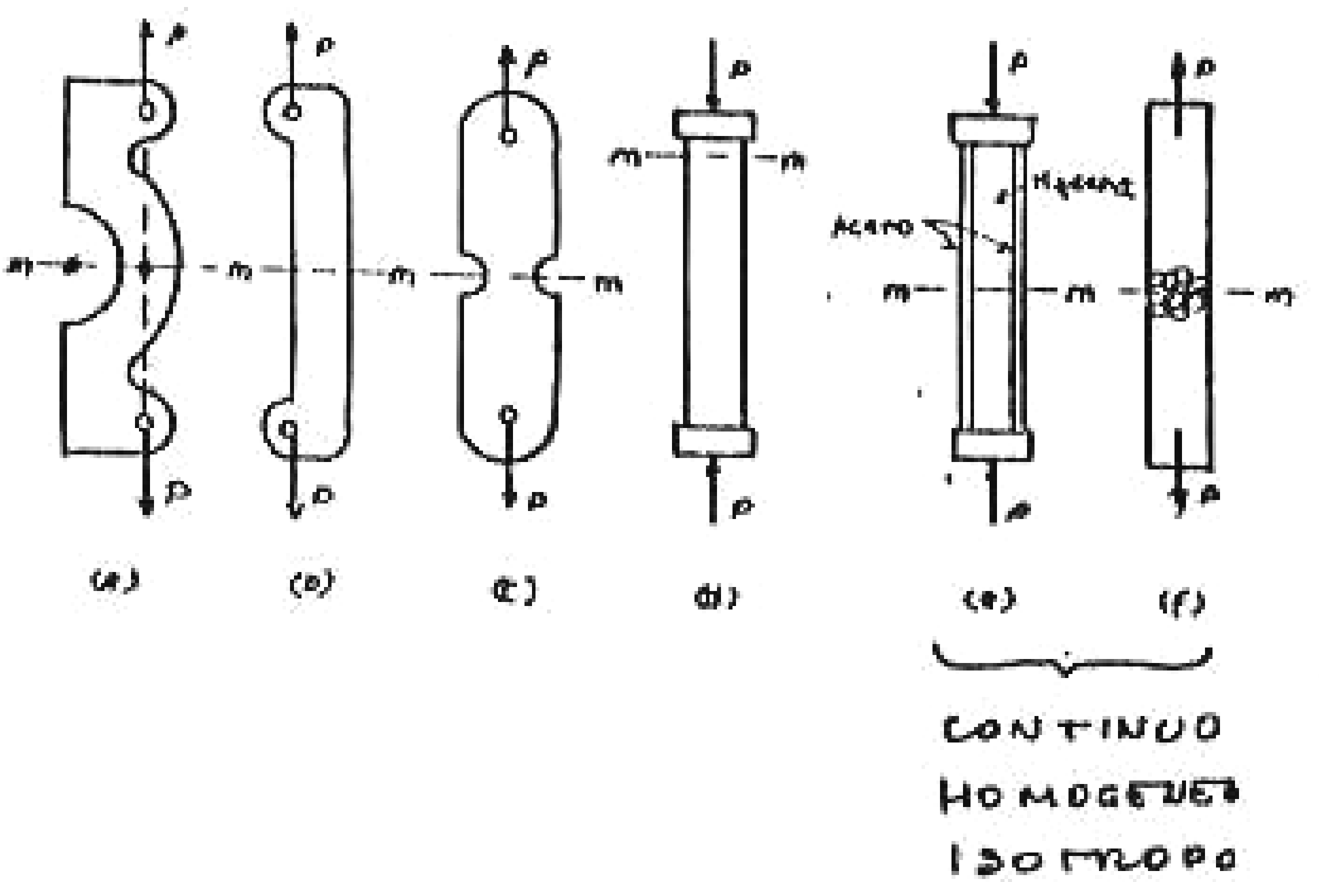
6. EL MATERIAL DEBE SER HOMOGENEO, ISOTROPO Y ELASTICO

c) ADEMAS

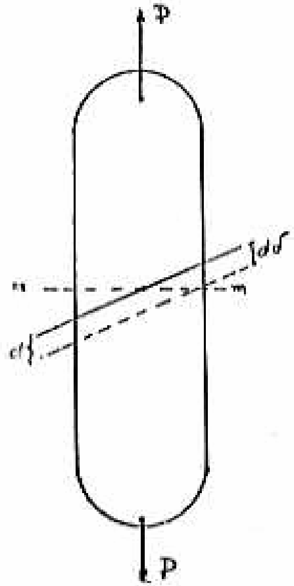
7- LA CARGA DEBE SER ESTATICA

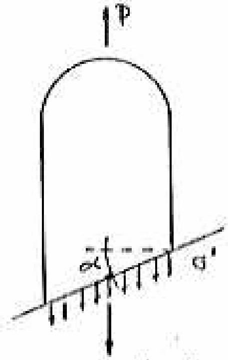
8- EL VALOR DE NO SERA EL REAL SI LA PIEZA TIENE TENSIONES INICIALES O RESIDUALES

CASOS EN LOS QUE NO ES APLICABLE LA FÓRMULA



SECCION OBLICUA

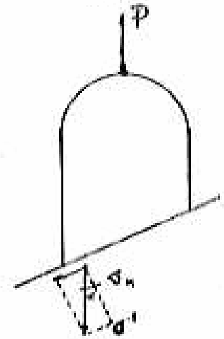




$$N = P$$

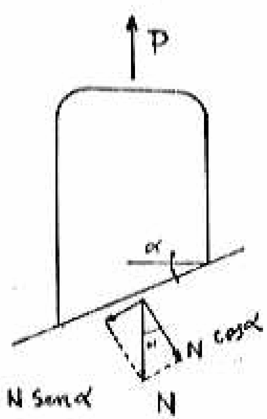
$$\sigma' = \frac{N}{A'}$$

$$A = A' \cos\alpha$$



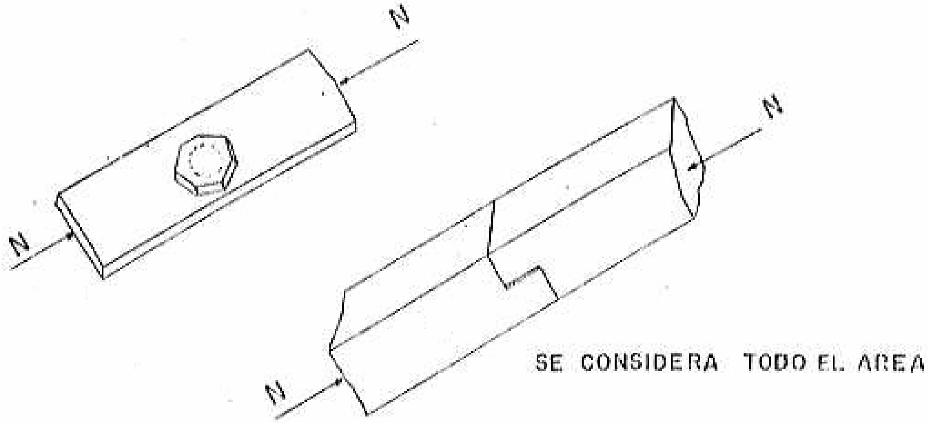
$$\sigma_n = \sigma' \cos\alpha \qquad \tau = \sigma' \operatorname{sen}\alpha$$

$$\sigma_n = \frac{N}{A'} \cos\alpha = \frac{N}{A} \cos^2\alpha \qquad \tau = \frac{1}{2}\frac{N}{A} \operatorname{sen} 2\alpha$$

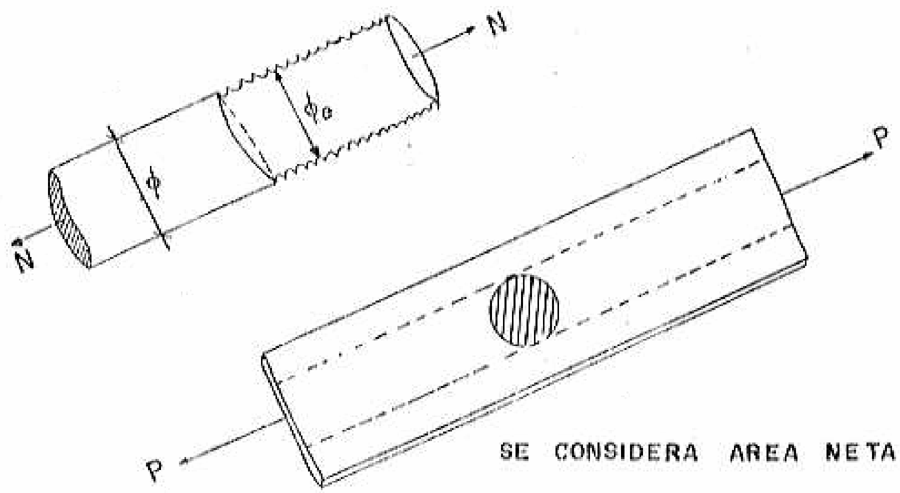


$$\sigma = \frac{N \cos\alpha}{A'} = \frac{N}{A}\cos^2\alpha \qquad \tau = \frac{N \operatorname{Sen}\alpha}{A'} = \frac{N}{A} \operatorname{Sen}\alpha \cos\alpha$$

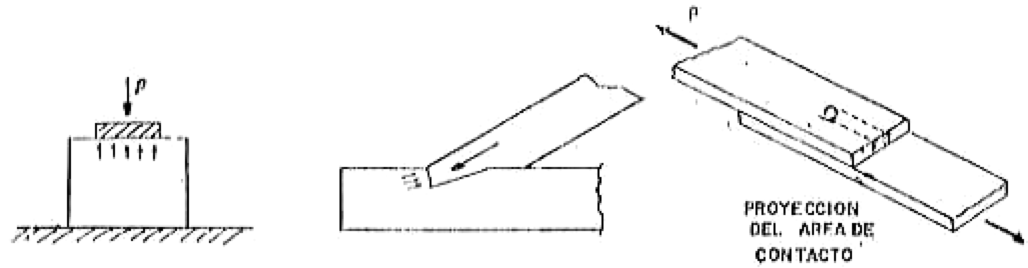
CUERPOS A COMPRESION



CUERPOS TRACCIONADOS



APLASTAMIENTO



TENSIONES DE CONTACTO

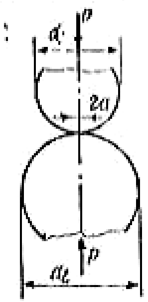
1- SE CUMPLE LA LEY DE HOOKE.

2- LAS DIMENSIONES LINEALES DEL AREA DE CONTACTO SON PEQUEÑAS EN RELACION A ρ

3- LA FUERZA DE COMPRESION ES NORMAL AL AREA DE CONTACTO

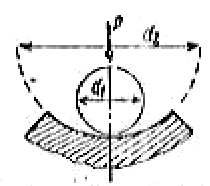
4- EN EL AREA DE CONTACTO SURGEN SOLAMENTE σ_n

a) ESFERAS :



$$a = 0.88 \sqrt[3]{\frac{P d_1 d_2}{E(d_1 + d_2)}}$$

$$p_{max} = 0.62 \sqrt[3]{P E^2 \left(\frac{d_1 + d_2}{d_1 d_2}\right)^2}$$



$$p_{max} = 0.62 \sqrt[3]{P E^2 \left(\frac{d_1 - d_2}{d_1 d_2}\right)^2}$$

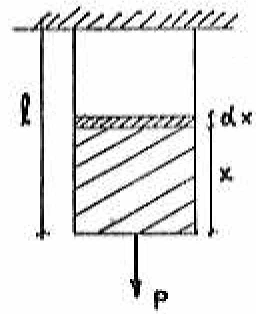
b) ESFERA SOBRE UN PLANO

$d_2 = \infty$ . . . . . . $p_{max} = 0.62 \sqrt[3]{\frac{P E^2}{d^2}}$

c) DOS CUERPOS CILINDRICOS

q = CARGA UNIF. DISTRIBUIDA $p_{max} = 0.59 \sqrt[3]{\frac{q E (d_1 + d_2)}{d_1 d_2}}$

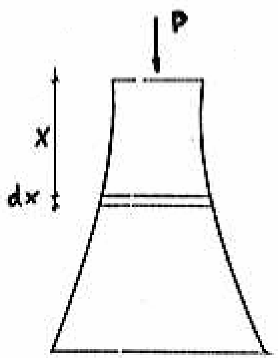
TENSIONES PRODUCIDAS POR EL PESO PROPIO



$$N = P + \gamma A . x \qquad \sigma = \frac{N}{A}$$

$$\boxed{\sigma = \frac{P}{A} + \gamma x}$$

CUERPO DE IGUAL RESISTENCIA



$$\sigma = \frac{P}{A_o} \qquad \sigma = \frac{P}{A_o} = \frac{P+G}{A} = \frac{P+G+dG}{A+dA} = \frac{dG}{dA}$$

$$dG = A \gamma \, dx$$

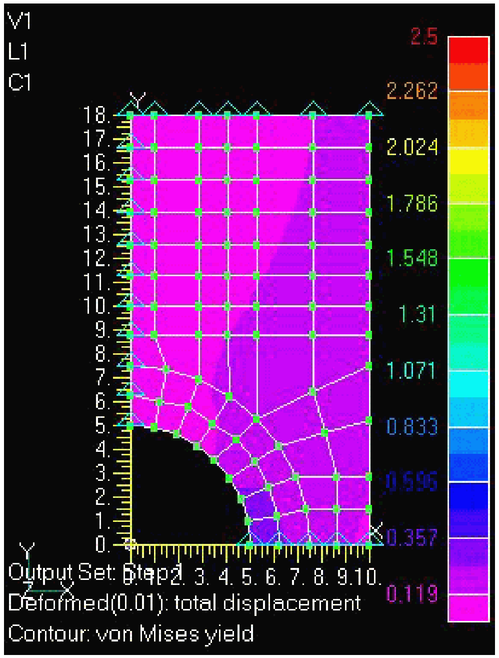
$$\frac{dA}{dG} = \frac{1}{\sigma} = \frac{dA}{A \gamma dx}$$

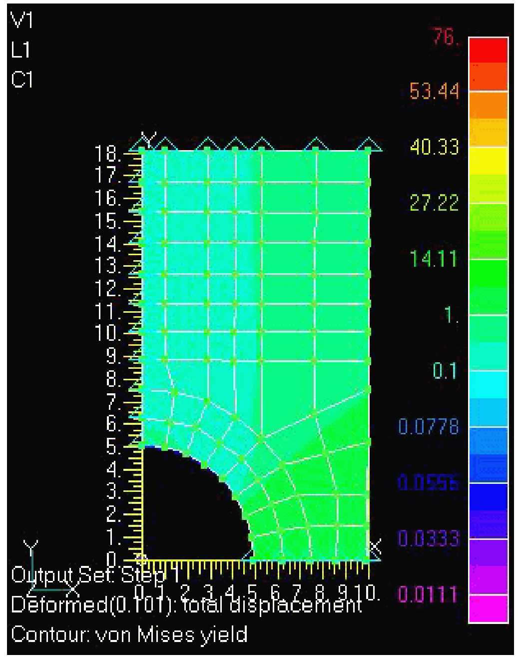
$$\frac{dA}{A} = \frac{\gamma}{\sigma} dx$$

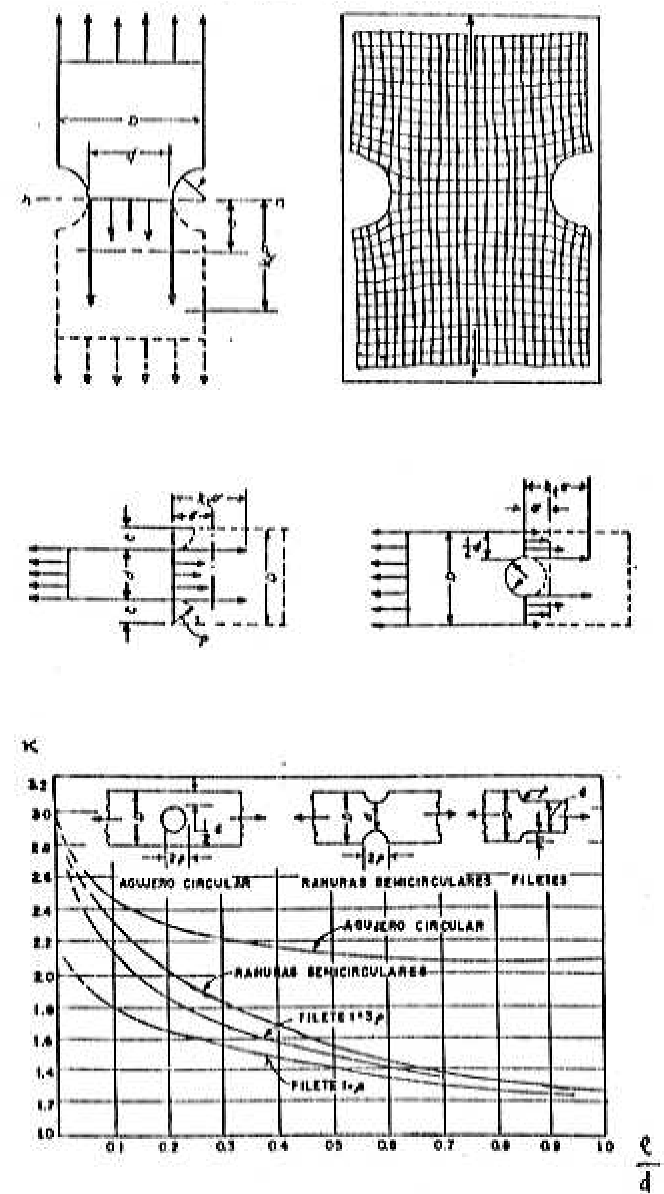
$$\ln A = \frac{\gamma}{\sigma} x + C$$

para $x = 0$ $A = A_o$ ...... $C = \ln A_o$

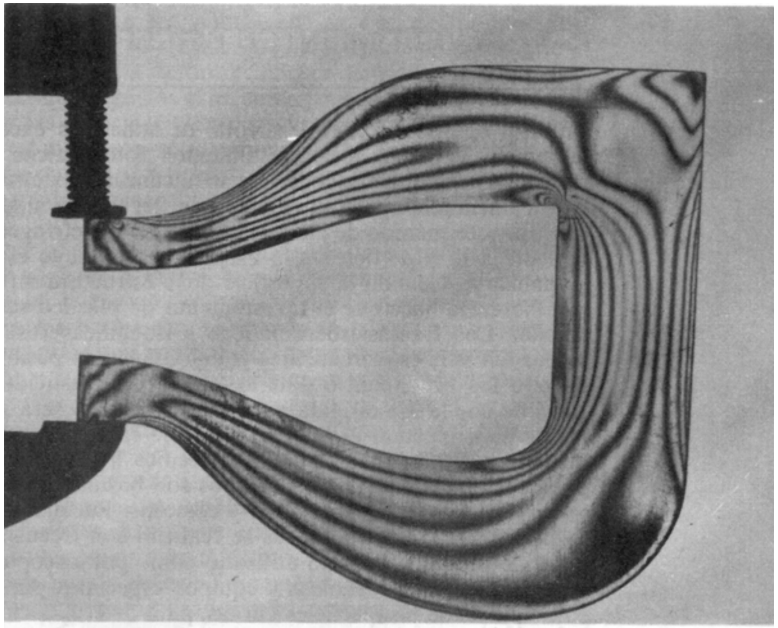
$$\ln \frac{A}{A_o} = \frac{\gamma}{\sigma} x \; \ldots\ldots \qquad \boxed{A = A_o \, e^{\frac{\gamma}{\sigma} x}}$$

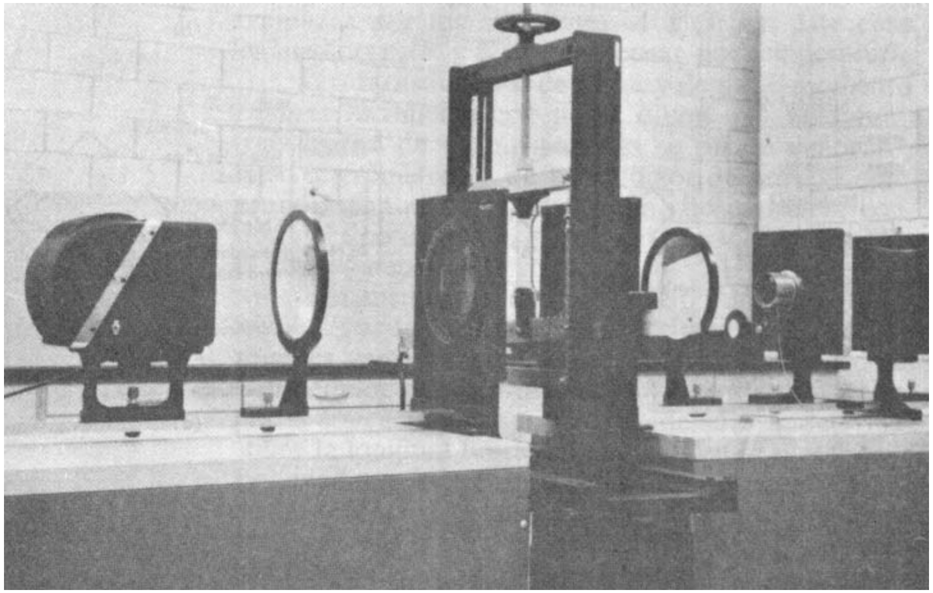

V1
L1
C1
2.5
2.262
2.024
1.786
1.548
1.31
1.071
0.833
0.596
0.357
0.119
Output Set: Step2
Deformed(0.01): total displacement
Contour: von Mises yield


V1
L1
C1
76.
53.44
40.33
27.22
14.11
1.
0.1
0.0778
0.0555
0.0333
0.0111
Output Set: Step1
Deformed(0.101): total displacement
Contour: von Mises yield


K
AGUJERO CIRCULAR
RANURAS SEMICIRCULARES
FILETES
AGUJERO CIRCULAR
RANURAS SEMICIRCULARES

DETERMINACIÓN DE TENSIONES POR MÉTODOS FOTOELÁSTICOS





Próxima Clase: Desplazamientos

Fin