

# BRODSKI STROJNI KOMPLEKSI



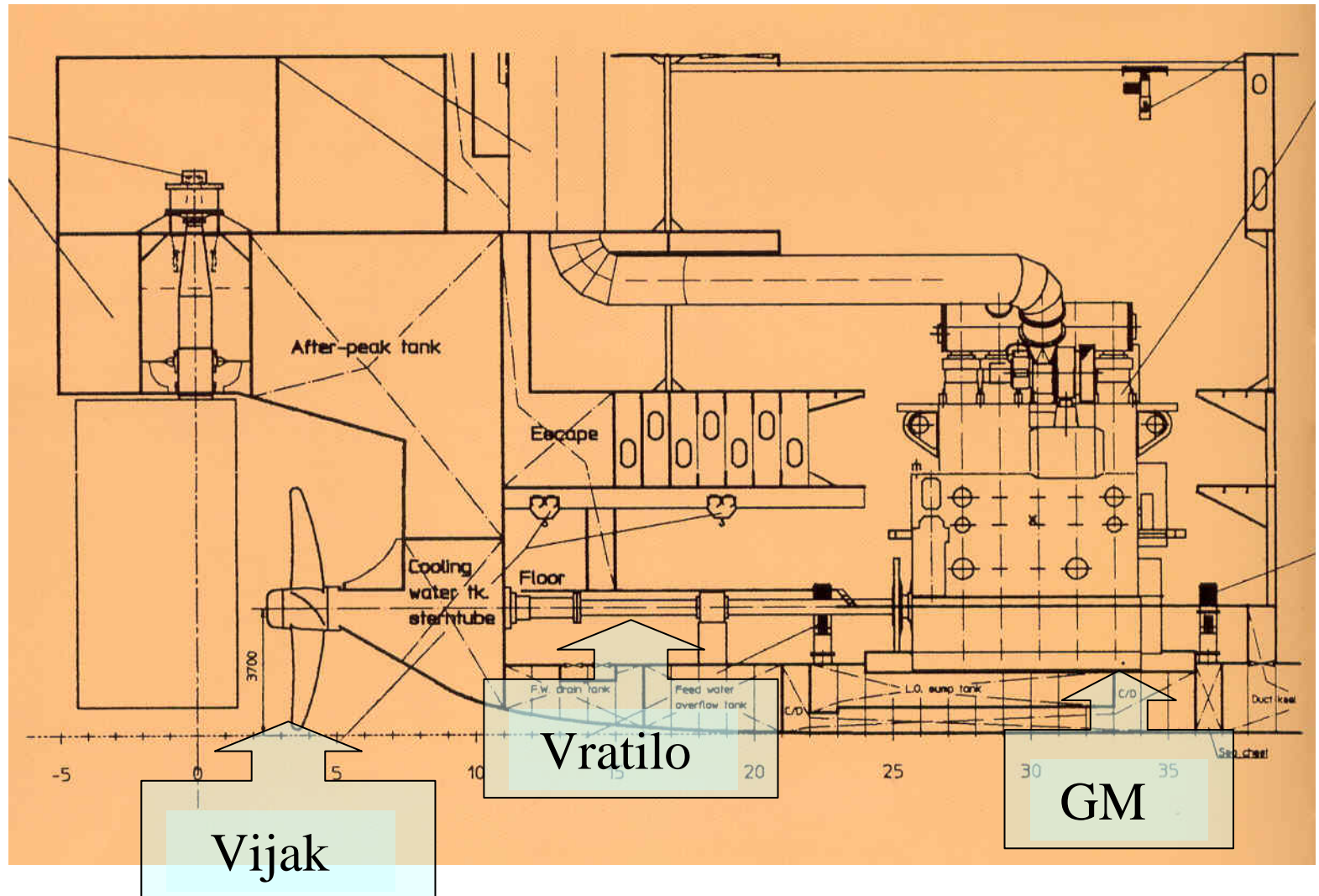
Porivni sustavi



# Porivni sustav

- porivni stroj
- prijenos snage
  - vratilo (propelerno, međuvratilo)
  - kod EM pogona: kabel (i vratilo)
- ležajevi
  - aksijalni - odrivni i radijalni ležaj(i)
- (reduktor)
- (spojka)
- propulzor (propeler – brodski vijak)

# Presjek kroz strojarnicu





# Porivni sustavi – podjela (prema vrsti porivnog stroja)

- dizelmotorna propulzija
- parnoturbinska propulzija
- plinskoturbinska propulzija
- elektromotorna propulzija
- kombinirani porivni sustavi



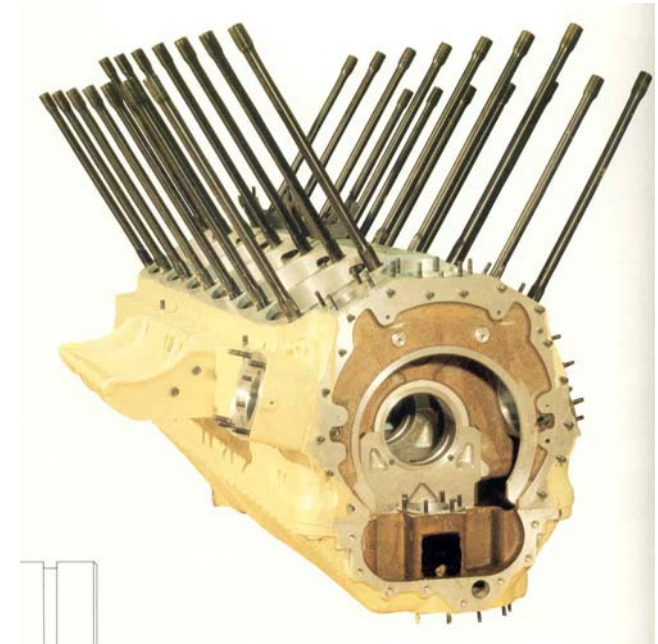
# Dizelmotorna

- sporookretni (sporohodni)
- nekad za  $P < 40000 \text{KS}$ , danas  $P > 70000 \text{kW}$
- propeler: fiksna krila, prekretni
- veliki  $\eta$
- jeftino gorivo
- nema reduktora
- vibracije i buka
- kompliciranost, masivnost  $\Rightarrow$  velike strojarnice
- nesiguran rad s malim  $n$
- složeni cjevovodi
- 95% brodova – sporookretni d. m.

# Dizelmotorna

- srednjehodni (brzohodni)
- propeler: fiksna krila, prekretni
- velik  $\eta$
- skuplje gorivo nego sporookretni
- reduktor
- vibracije i buka
- kompliciranost
- manje dimenzije strojarnica
- više motora  $\Rightarrow$  više propulzora  $\Rightarrow$  **veća sigurnost pogona**
- putnički, RO-RO

V IZVEDBA





# Parnoturbinska

- višestepene i višekučišne turbine
- manji  $\eta$  (40%)
- male vibracije
- veliki broj okretaja → reduktor
- velike snage?
- sigurnost (zbog više kućišta)
- generator pare – kotlovnica
- KLN, KIP, nuklearni
- jednostavniji sustavi
- putnički, velike snage, brzi kontejneraši



# Plinskoturbinska

- manji  $\eta$  (30%)
- brzo startanje i dobar  $P/m \rightarrow$  ratni
- veliki broj okretaja  $\rightarrow$  reduktor
- bolje gorivo (zaštita okoliša)
- manje strojnih sustava, a i jednostavniji su
- danas primjena kod elektropropulzije





# Elektromotorna

- generatori: DM, PaT, PIT, kombinacije
- fina regulacija okretaja i kod malih  $n$
- prije AC/DC, danas AC/AC
- putnički, precizno pozicioniranje
- raspored prostorijski, tankova, strojnih prostora
- jednostavniji strojni sustavi



# Kombinirana

- **CO**mbined **D**iesel **O**r **G**as turbine
- **CO**mbined **D**iesel **A**nd **G**as turbine
- **CO**mbined **D**iesel e**L**ectric **A**nd **G**as turbine
- **CO**mbined **G**as **E**lectric and **S**tream turbine
- ...



# Prijenos snage

- $\eta_P - D, n$

- direktan

  - krut: prirubnica ili kruta spojka

  - elastičan: elektromagn. i hidrauličke spojke

- indirektan

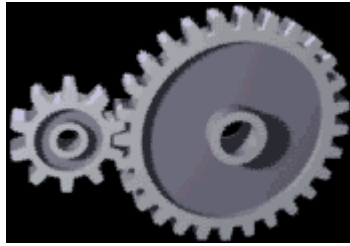
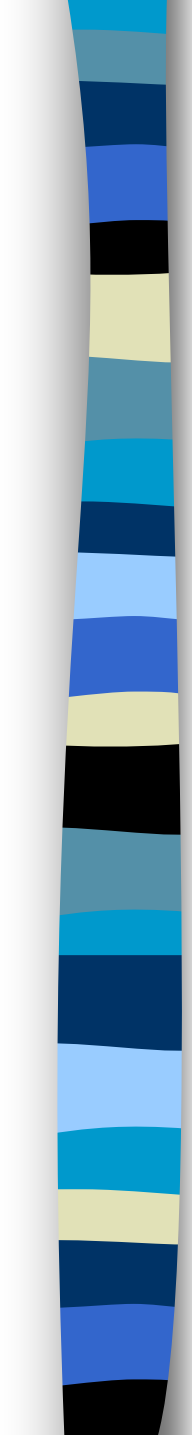
  - zupčani prijenos (97-99%)

  - električni prijenos

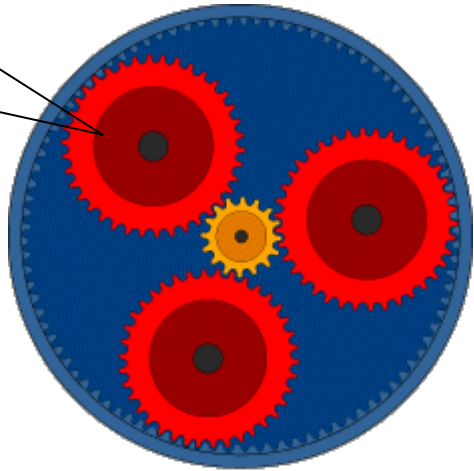


# Reduktor

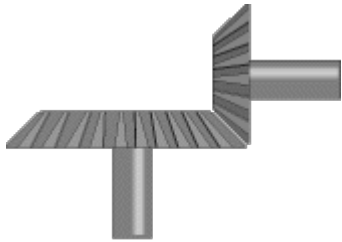
- prijenos snage pri različitim brzinama vrtnje, momentima i smjerovima
- prijenosni omjer:  $i = n_1/n_2 = d_2/d_1 = z_2/z_1$
- trenje – gubici – podmazivanje
- cijena
- priprema pogona
- sigurnost poriva



PLANET

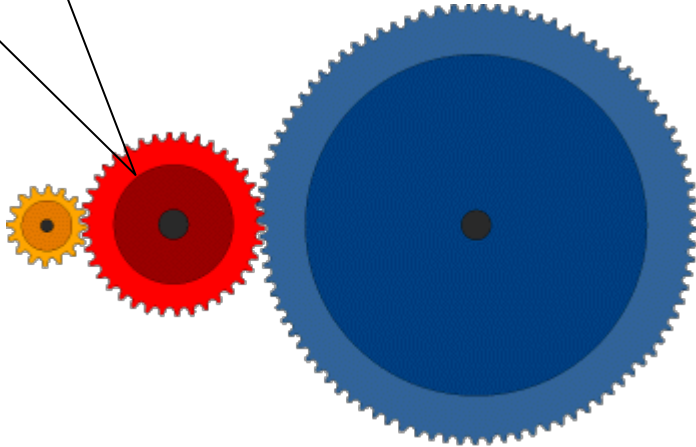


©2000 How Stuff Works



©2000 How Stuff Works

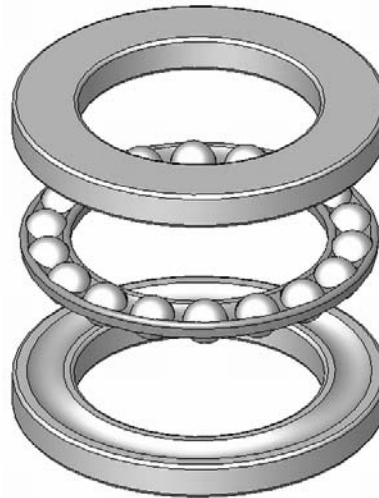
PLANET



©2000 How Stuff Works

# Ležajevi

- radijalni – nose vratilni vod
- aksijalni (odrivni) – preuzimaju porivnu silu stvorenu radom brodskog vijka
- klizni



# Propulzor

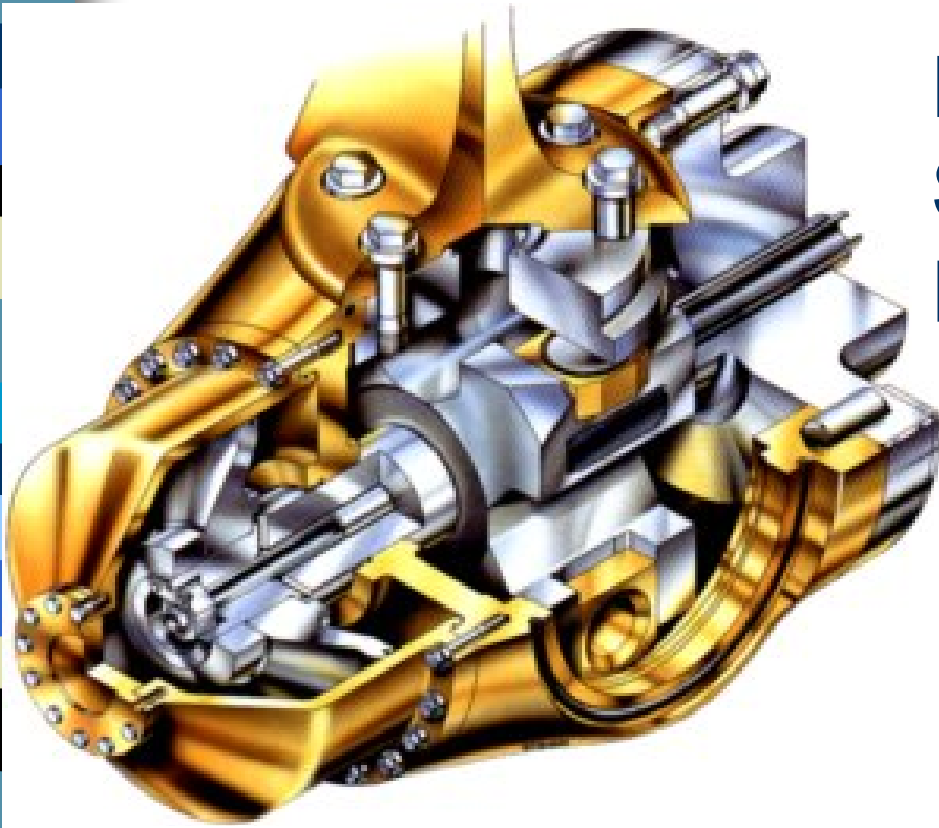
- brodski v  
– s fiksnir  
– prekretr
- dr. izvedl  
– u sapnic  
– podtrup  
mehanic



Our product information provides you with expressions and data for planning plants incorporating units from our catalogue. On account of the modifications associated with upgrading, the contents of a specific edition will remain valid for a limited period. For the application concerned are the data given in our tender specification.

- FWAP

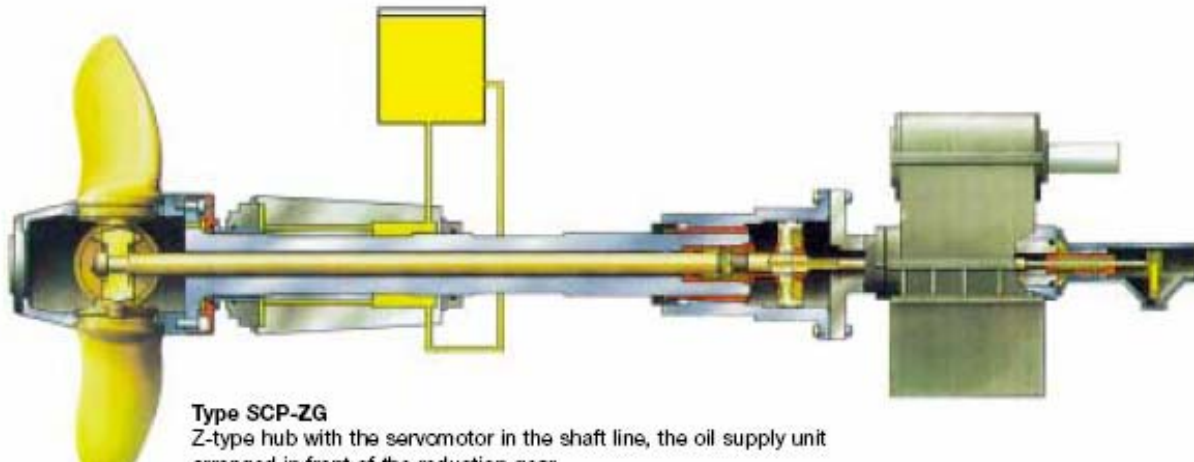
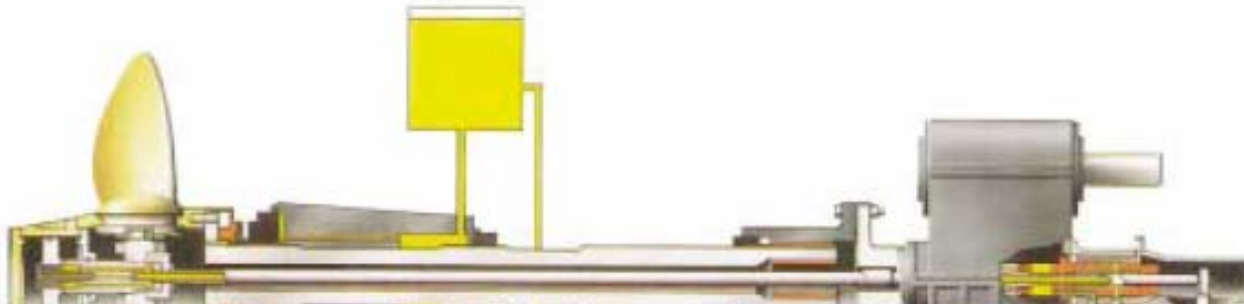
# PROPELER SA ZAKRETNIM KRILIMA



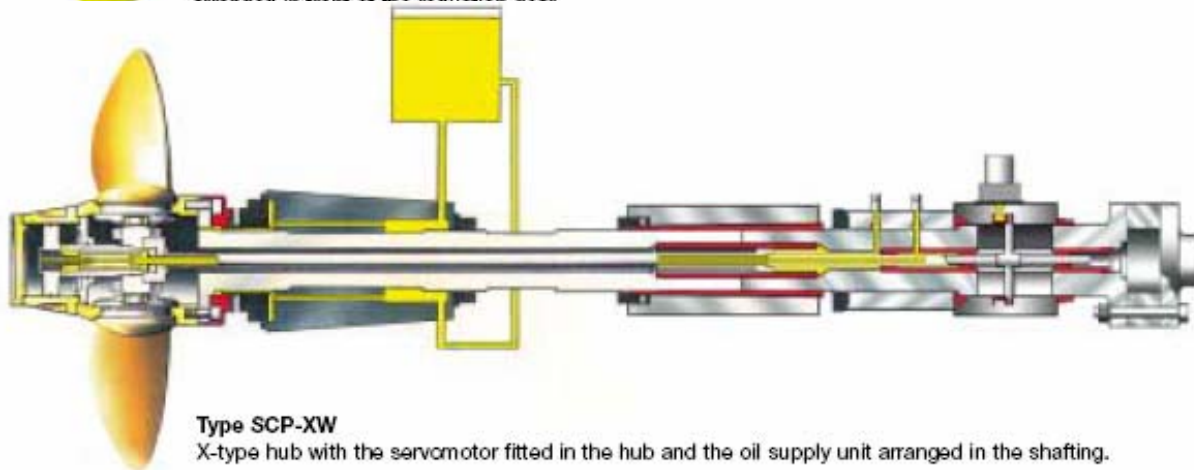
1. štiti propeler
2. usmjerava vodu
3.  $\eta$  poriva





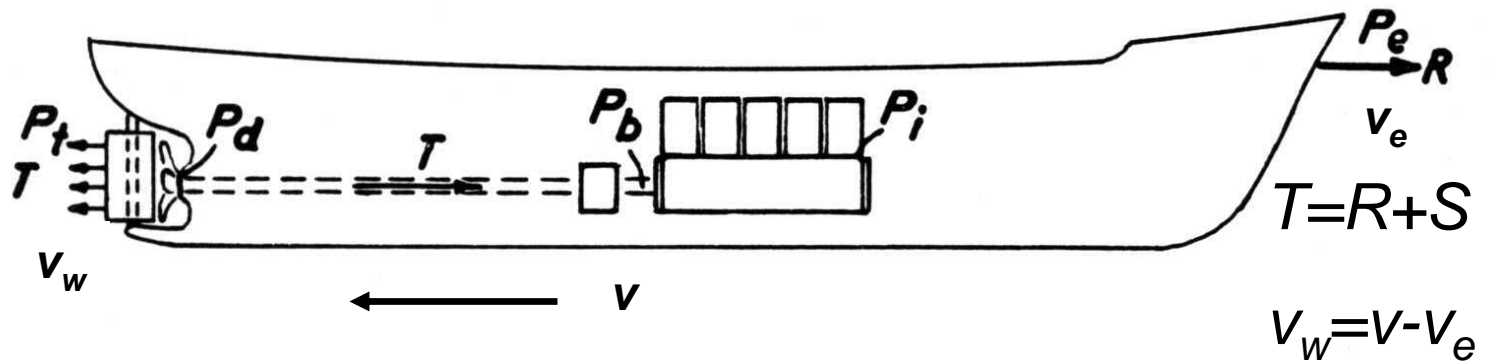


**Type SCP-ZG**  
Z-type hub with the servomotor in the shaft line, the oil supply unit  
arranged in front of the induction motor.



**Type SCP-XW**  
X-type hub with the servomotor fitted in the hub and the oil supply unit arranged in the shafting.

# Stupanj iskoristivosti poriva



$$\eta_p = \frac{P_b}{P_i} \cdot \frac{P_d}{P_b} \cdot \frac{P_t}{P_d} \cdot \left(\frac{P_e}{P_t}\right)$$

$$\eta_p = \frac{P_e}{P_i}$$

$$\eta_p = \eta_m \cdot \eta_o \cdot \eta_p \cdot (\eta_h)$$

# Slip ili skliz

- prividni ili stvarni
- odnos teoretskog gibanja vijka i brzine strujanja vode ili brzine broda

$$s_a = \frac{\frac{Hn}{60} - v}{\frac{Hn}{60}} [\%]$$

$$s_r = \frac{\frac{Hn}{60} - v_e}{\frac{Hn}{60}} [\%]$$

# Mjerenje snage glavnog stroja

- na osovini:  $P_s = M_t \cdot \omega$      $\omega = 2\pi \cdot n$
- torziometar     $\sigma = \frac{M_t}{W_p}; \sigma = E \cdot \varepsilon \Rightarrow M_t = EW_p \cdot \varepsilon$
- optički
- DM: indikator
- DM: procesni

$$P_i = p_i \cdot \frac{D^2 \pi}{4} \cdot \frac{S \cdot n}{30} \cdot z \cdot \tau$$