

ISTOSMJERNI STROJEVI

jedini strojevi do Tesle a onda marginalizirani

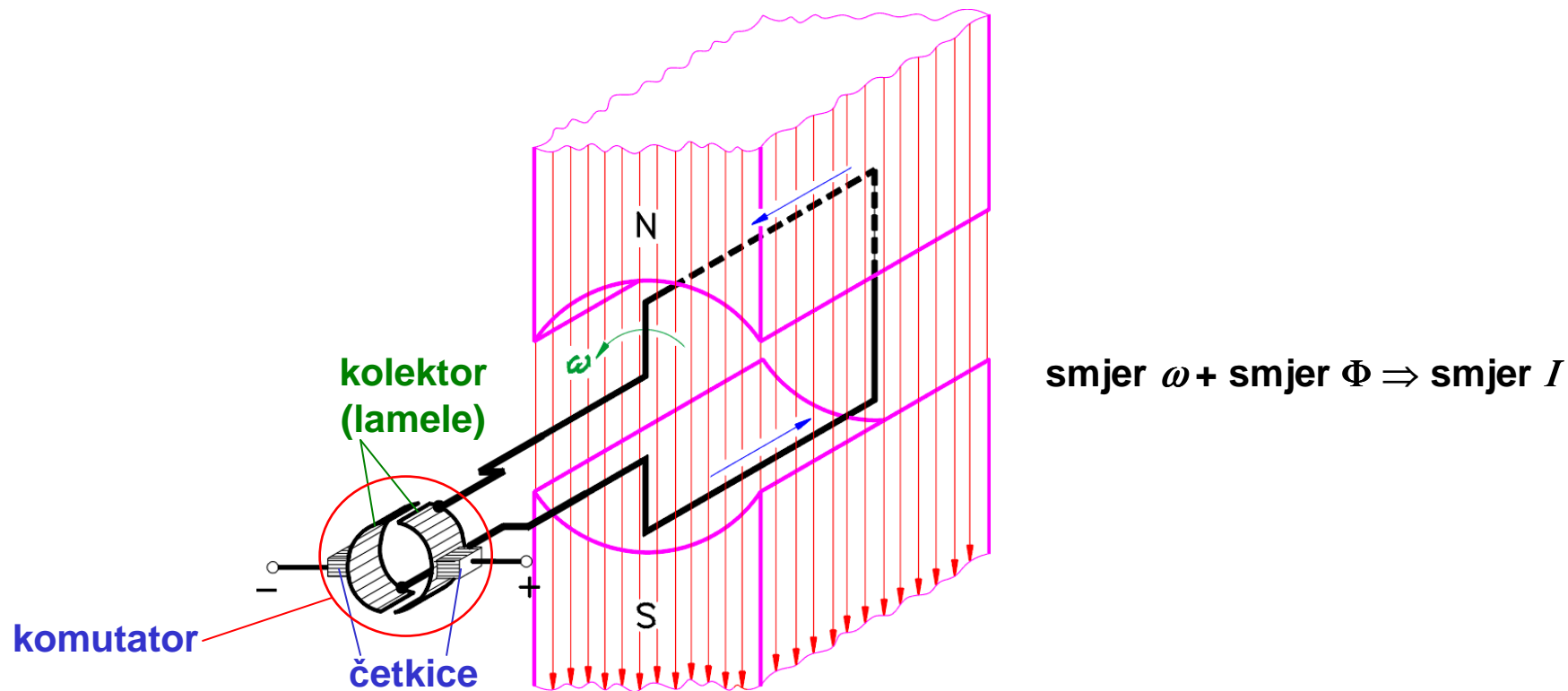
bili nezamjenjivi za promjenjivu brzinu vrtnje i promjenjivi moment

glavna mana komutacija (održavanje i smetnje)

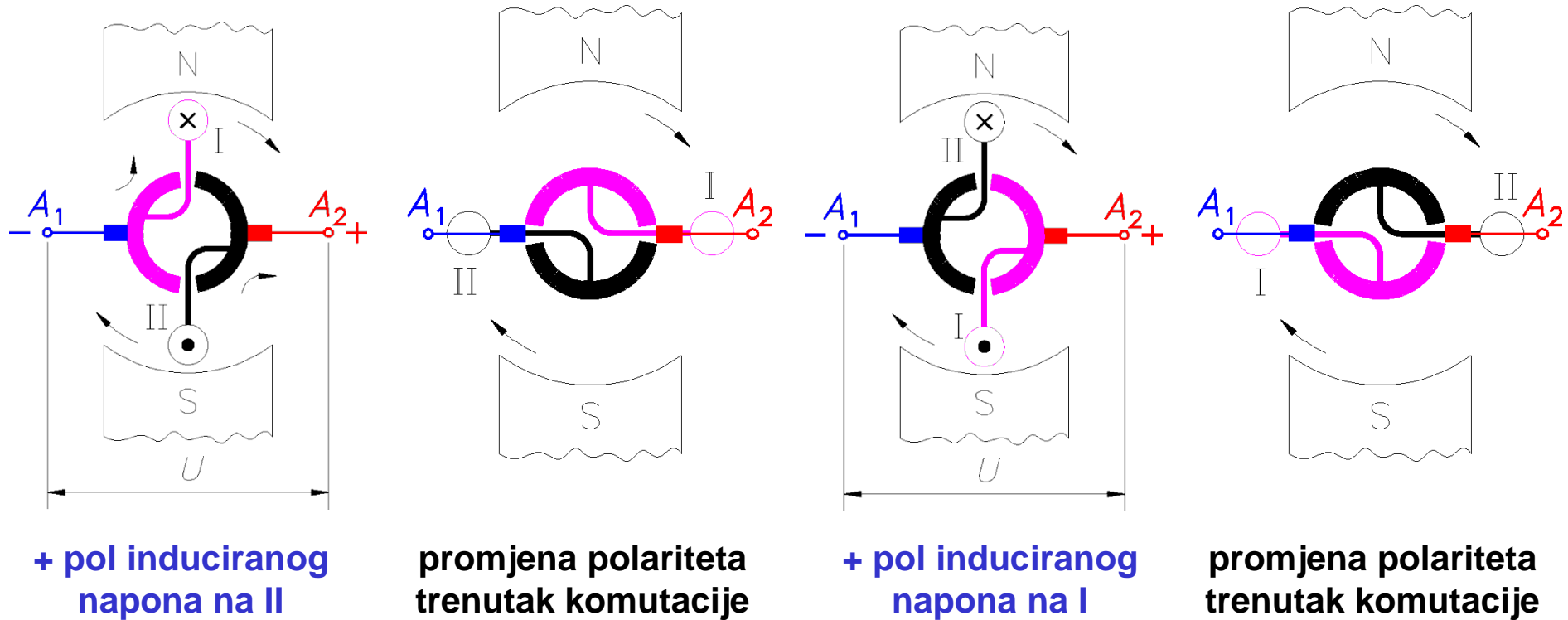
danas - nezavisna uzbuda s poluvodičkim komponentama i komutacijom na statoru

uzbudni namot na statoru - armaturni namot na rotoru

Induciranje istosmjernog napona

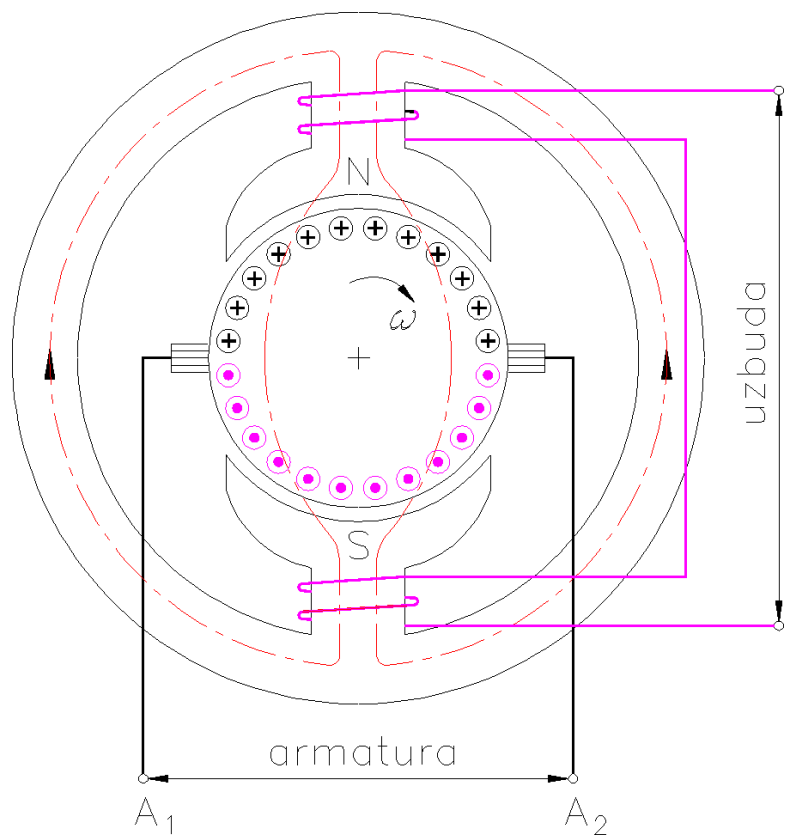


Komutiranje induciranog napona (struje) u istosmjerni



četkice u neutralnoj zoni (okomito na glavno magnetno polje)
komutacija pri trenutna vrijednosti induciranog napona 0

dvopolni stroj

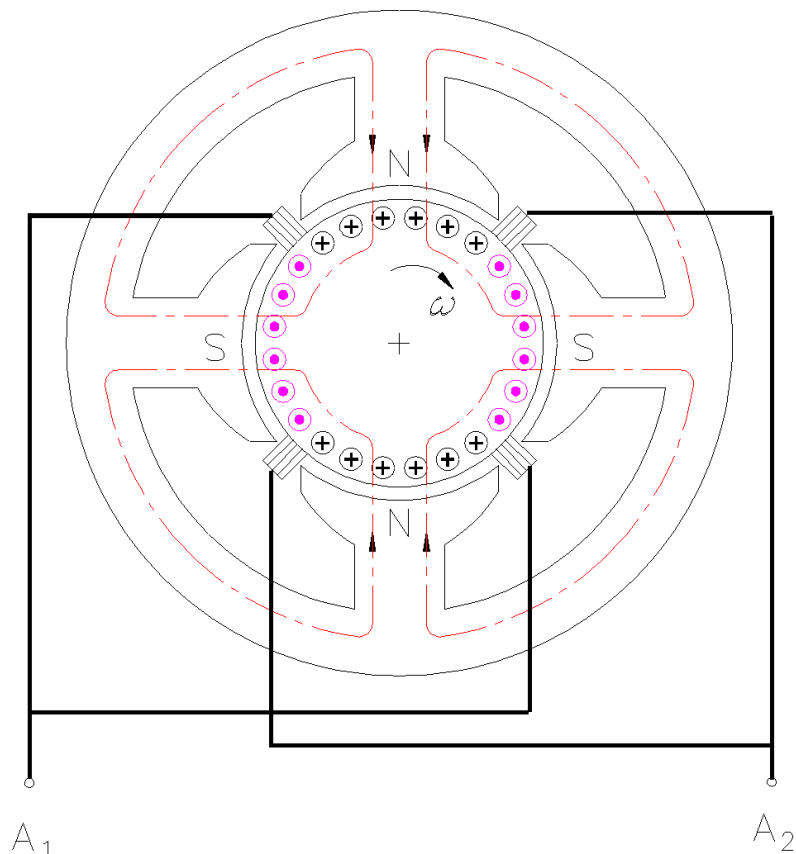


jedno

homogenih magnetnih polja

cijeli ciklus = jedan okretaj

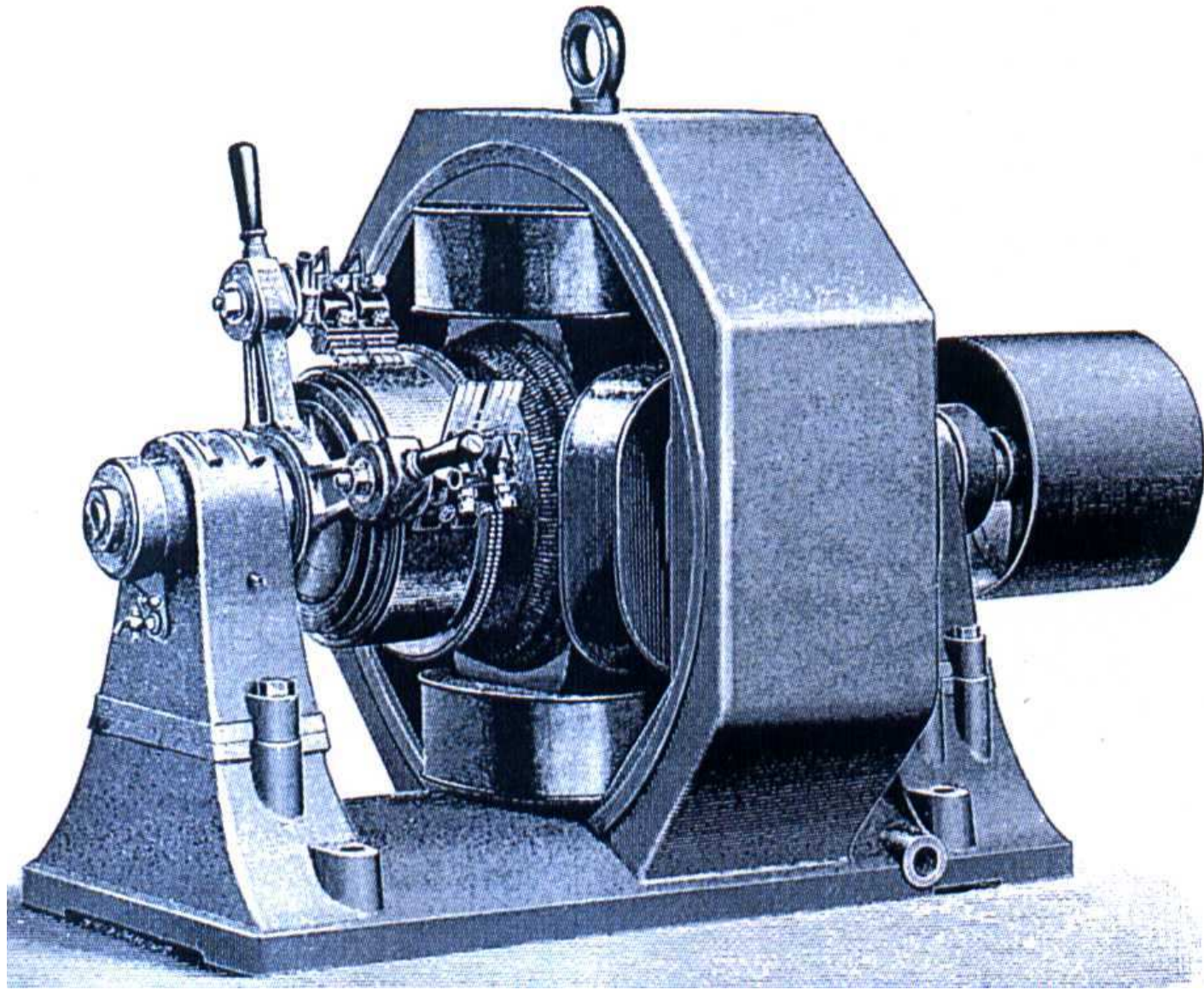
četveropolni stroj



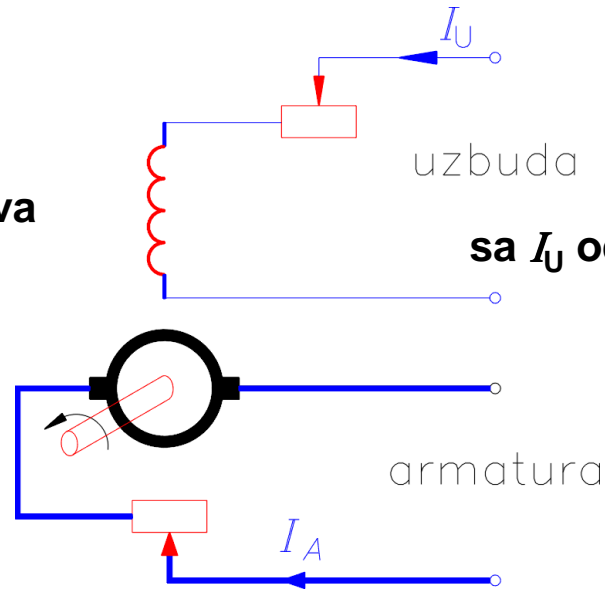
dva

cijeli ciklus = pola okretaja

uz jednak n namota rotora za jednake vrijednosti napona \Rightarrow više polova = manja brzina vrtnje



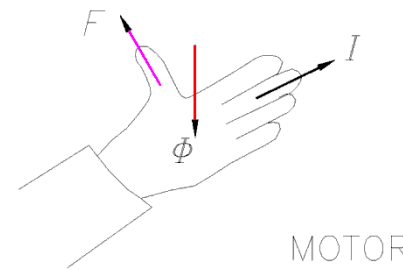
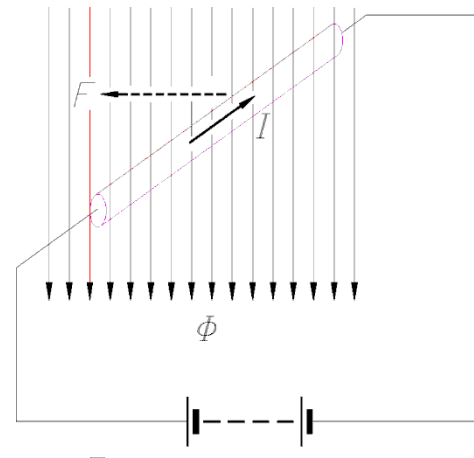
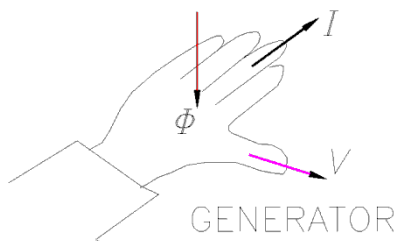
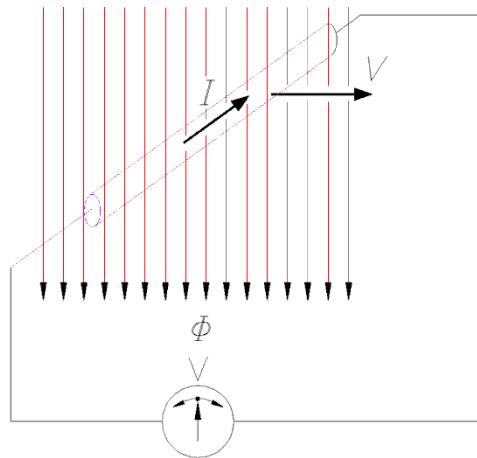
strujni krugovi
istosmjernih strojeva



nezavisni (regulirani pogoni)
zavisni (stalni odnos I_U i I_A)

sa I_U određivanje $B \Rightarrow$ inducirani U armature

sa I_A biranje funkcije stroja

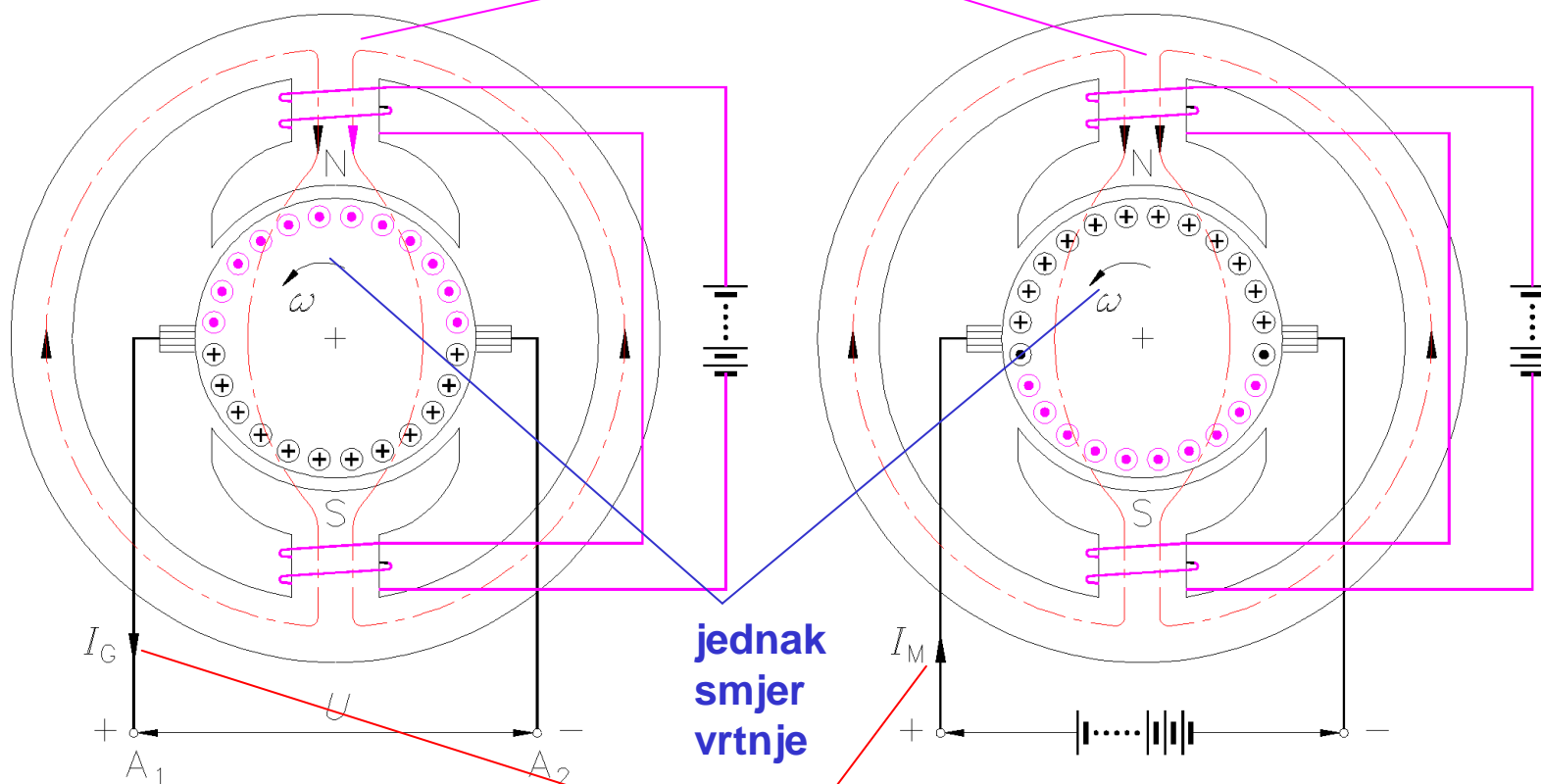


za isti smjer struje i
magnetnog polja
suprotni smjerovi
gibanja vodiča kod
generatora imotora

istosmjerni generator

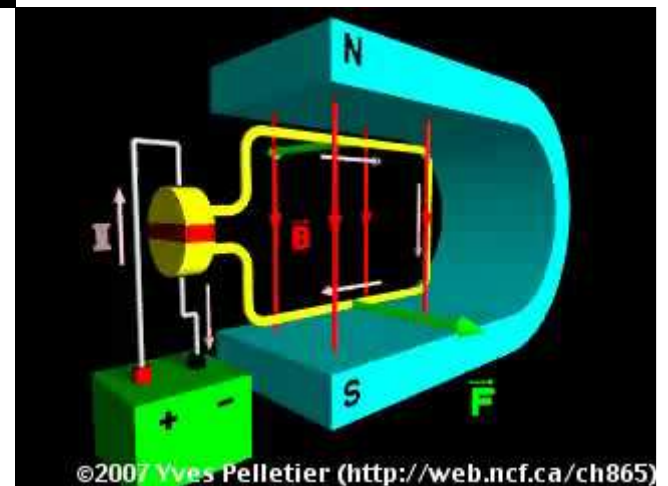
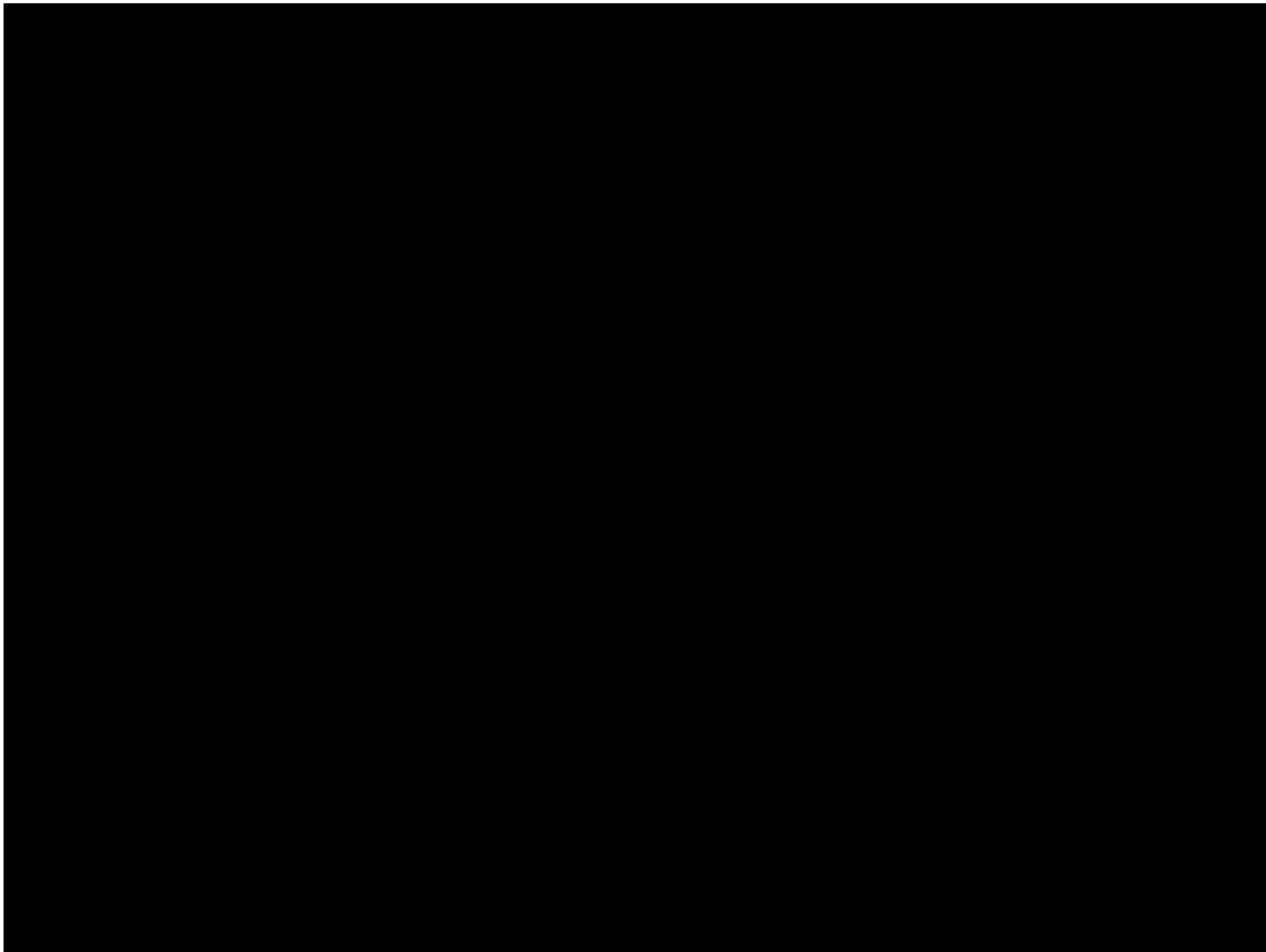
istosmjerni motor

jednak smjer struje uzbude (magnetskog polja uzbude)

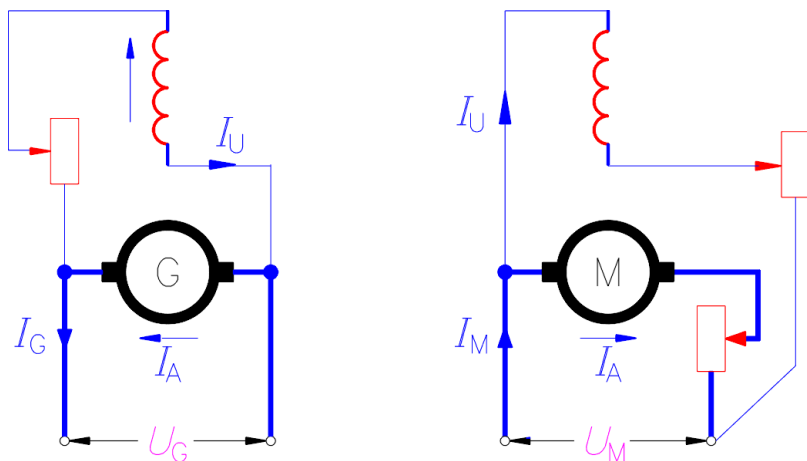


jednak smjer vrtnje

suprotni smjerovi struja armatura



zavisni (paralelni) istosmjerni strojevi



srednja vrijednost induciranog napona rotora

$$u_{is} = N \frac{\Delta\Phi}{\Delta t} \quad \text{uz } \Delta\Phi = 2 \cdot \Phi \quad \text{i} \quad \Delta t = \frac{60}{n \cdot p}$$

zavoji rotora +Φ do -Φ vrtnja polova

a ukupni inducirani napon

$$E = 2 \cdot \Phi \cdot \frac{N}{z} \cdot \frac{n \cdot p}{60} = \frac{\Phi \cdot N \cdot n \cdot p}{30 \cdot z} \quad (\text{V})$$

paralelnih grana namota

ili $E = B \cdot l \cdot v \quad (\text{V})$

pad napona na namotu rotora (armature)

$$\Delta U_A = I_A \cdot R_A$$

uz poznati E za generator $U = E - I_A \cdot R_A$
 U (stezaljke) za motor $U = E + I_A \cdot R_A$

prema \Rightarrow

$$E = k \cdot \Phi \cdot n \quad \uparrow \Phi \Rightarrow \uparrow E (U)$$

$$n = \frac{E}{k \cdot \Phi} \approx \frac{U}{k \cdot \Phi} \quad \uparrow \Phi \Rightarrow \downarrow n \quad \text{i} \Leftrightarrow$$

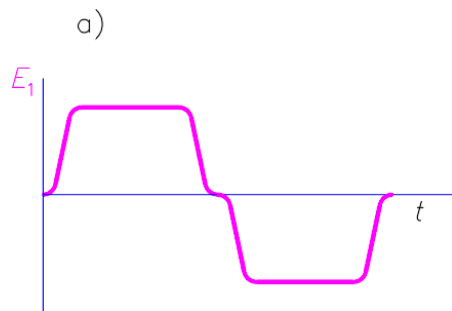
sila je $F = B \cdot I \cdot l \quad (\text{N})$ a moment motora $M = 2 \cdot F \cdot r = B \cdot I \cdot l \cdot 2r = B \cdot S \cdot I = \Phi \cdot I \quad (\text{Nm})$

$$M = k \cdot \Phi \cdot I \quad (\text{Nm}) \quad \uparrow I \text{ ili } \uparrow \Phi \Rightarrow \uparrow M$$

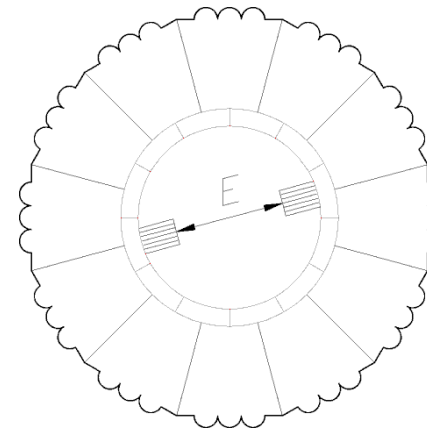
struja armature

proporcionalno I_U

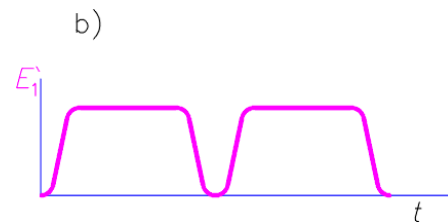
Inducirani napon i komutirani napon armature



**inducirani
napon
jednog
zavoja**

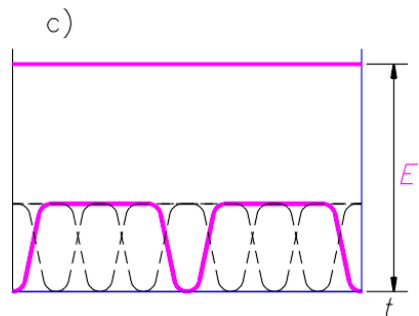


**spoj svih
namota
petljasto
izvedene
armature**

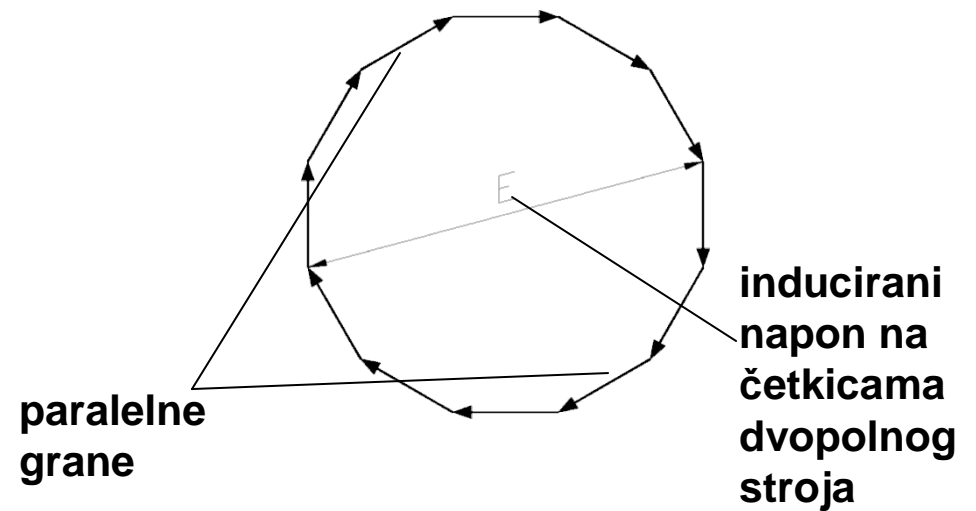


**komutacijom
ispravljeni
napon
jednog
zavoja**

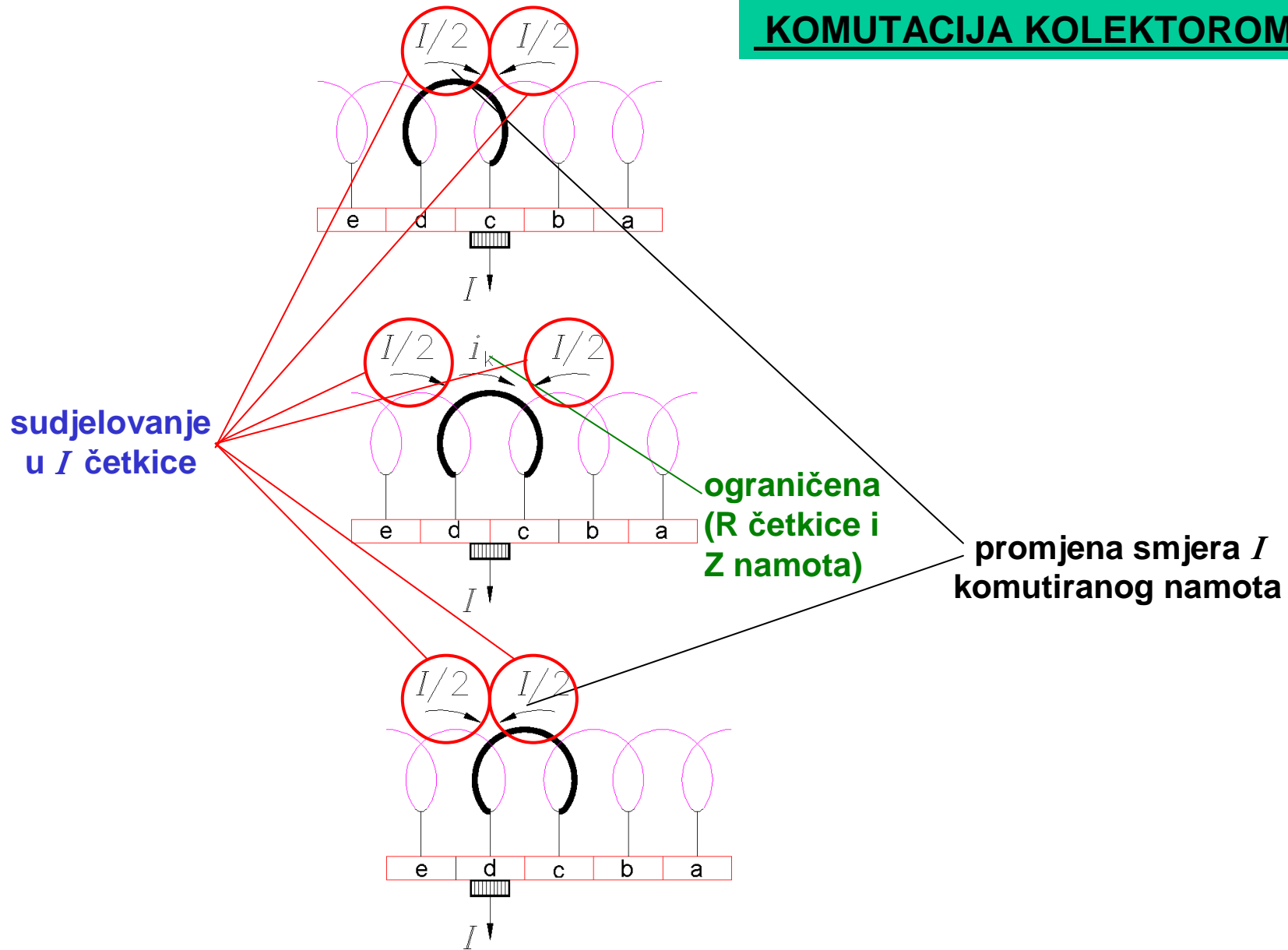
**induciraju se višefazni naponi
kazala svih namota
petljasto izvedene armature**



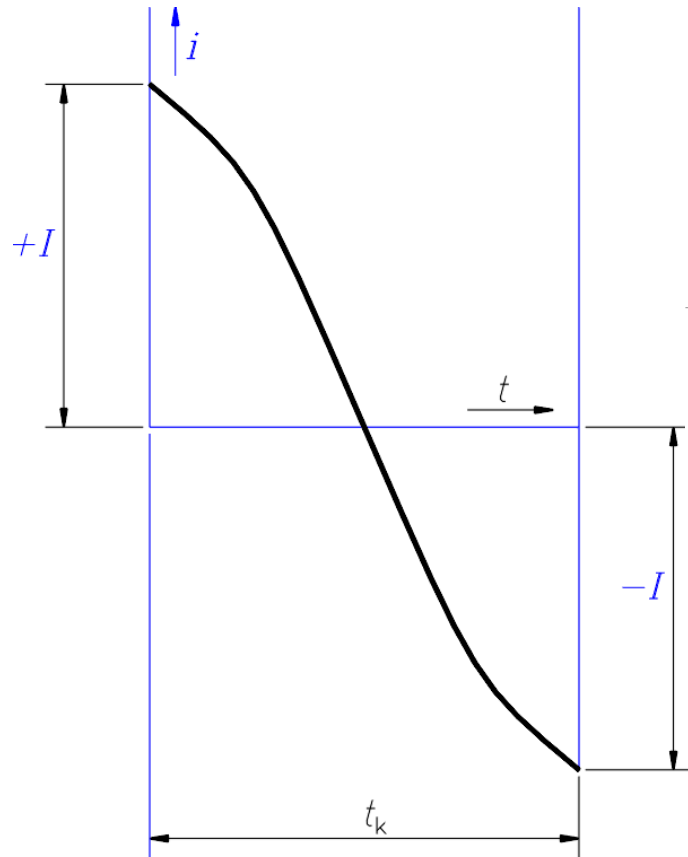
**ukupni
komutacijom
ispravljeni
napon svih
zavoja**



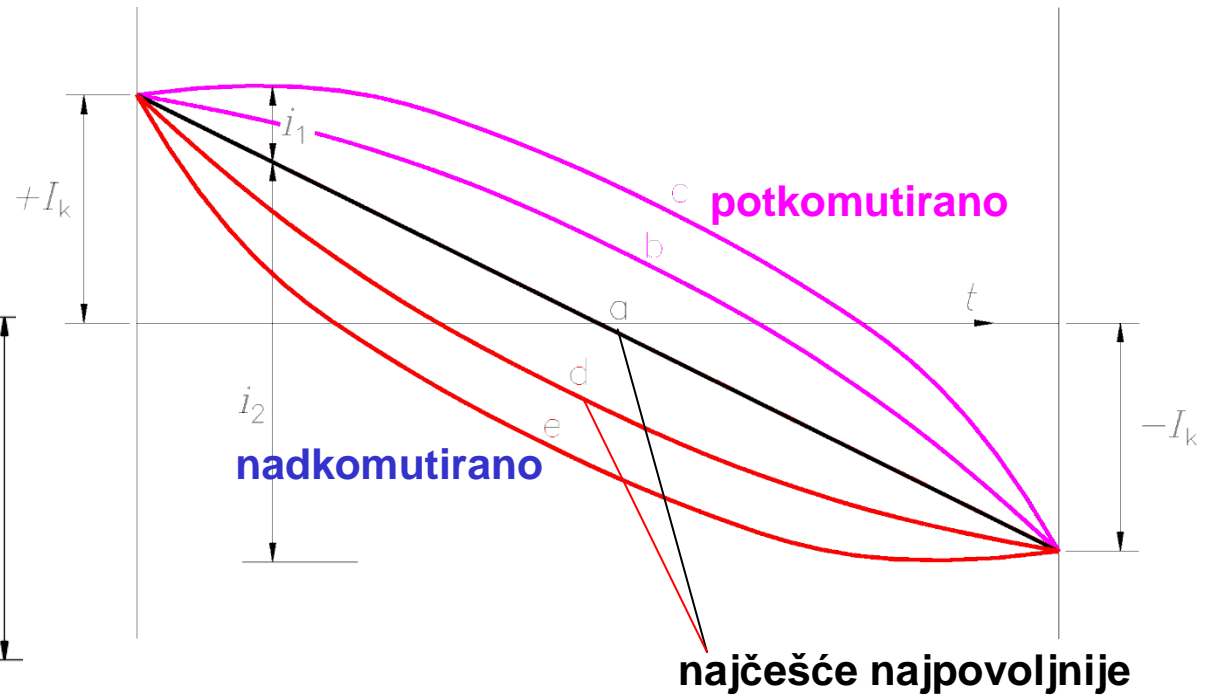
KOMUTACIJA KOLEKTOROM



L namota \Rightarrow protivnjenje promjeni smjera struje \Rightarrow induciranje prenapona \Rightarrow iskrenje

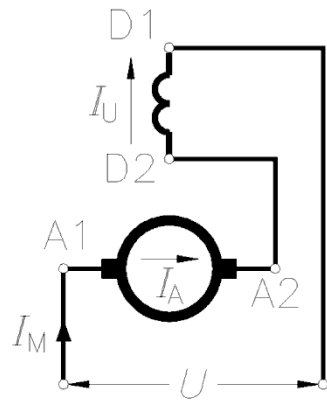


vrijeme komutacije

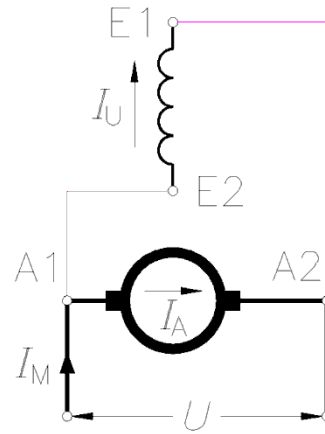


promjena struja u komutacijskom svitku

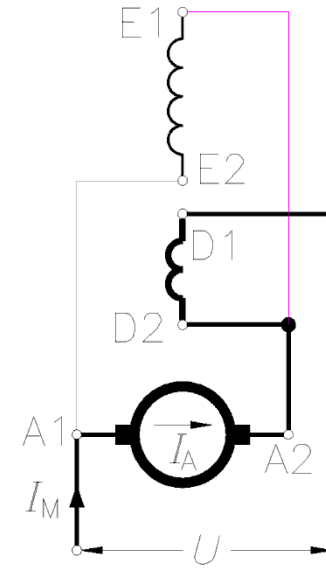
SPOJEVI ISTOSMJERNIH STROJEVA



serijski spoj
serijski stroj



paralelni spoj
poredni stroj



mješoviti spoj
kompandni stroj

označivanje priključaka strojeva

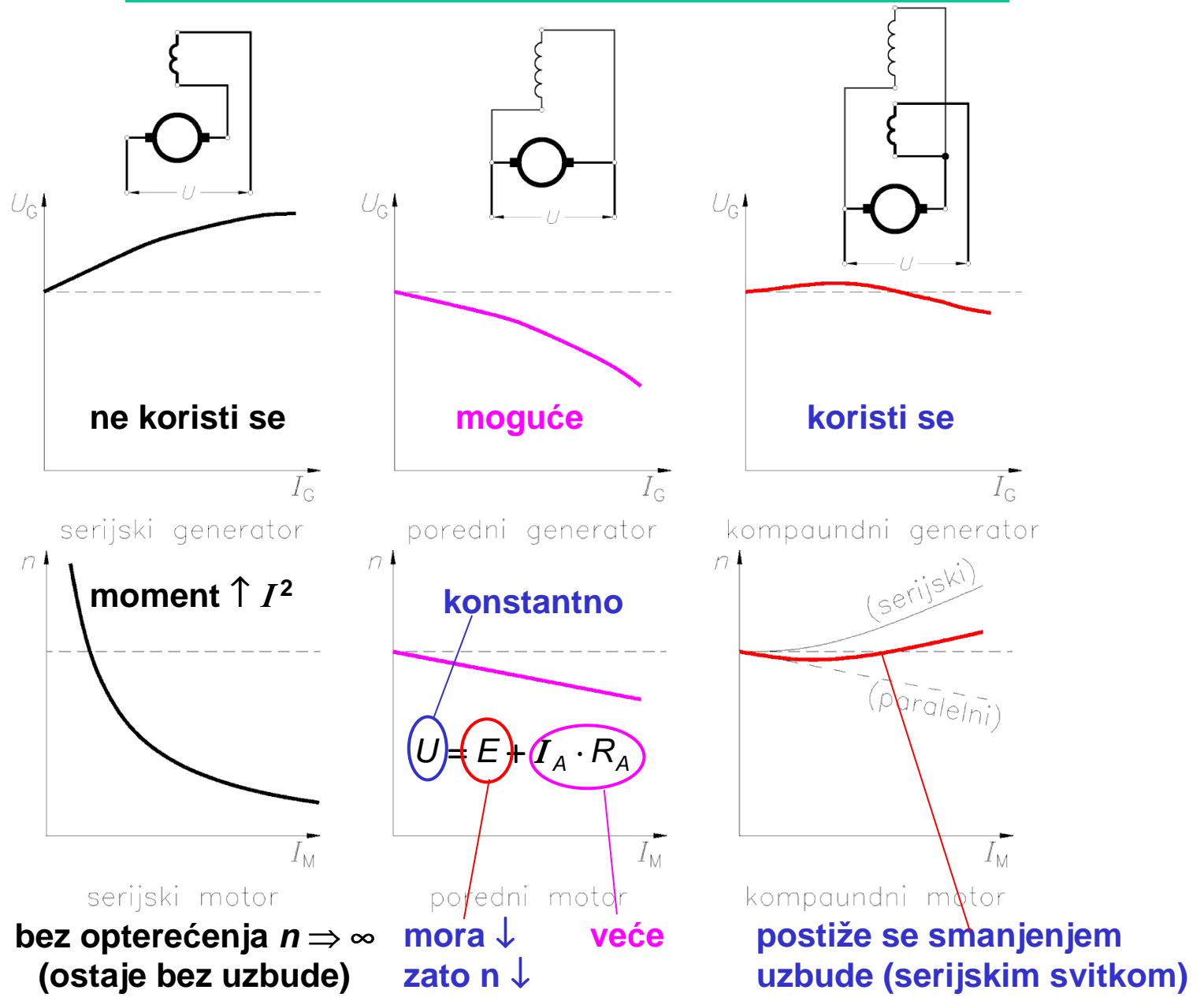
serijski stroj četkice - A1 A2 (A B) uzbudni svitak - D1 D2 (E F)

poredni stroj četkice - A1 A2 (A B) uzbudni svitak - E1 E2 (C D)

kompandni stroj četkice - A1 A2 (A B) uzbudni svitci - D1 D2 (E F) i E1 E2 (C D)

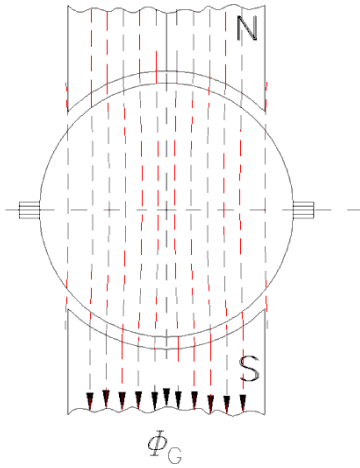
nezavisna uzbuda četkice - A1 A2 (A B) uzbudni svitci - F1 F2

KARAKTERISTIKE ISTOSMJERNIH STROJEVA

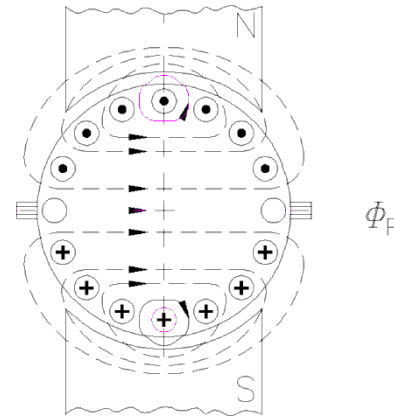


REAKCIJA ARMATURE

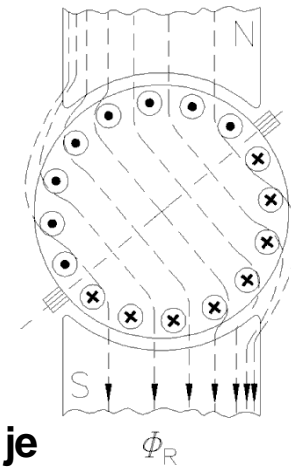
samo polje pobude
(prazni hod - zanemariva struja armature)



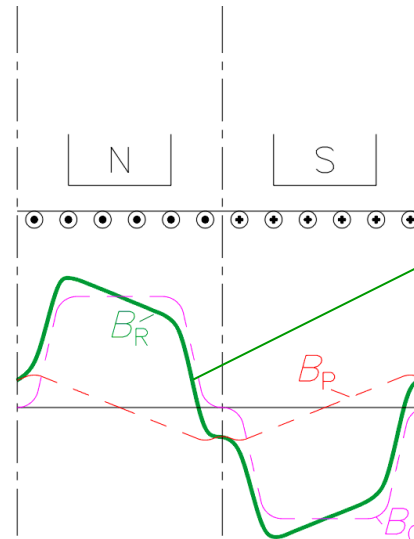
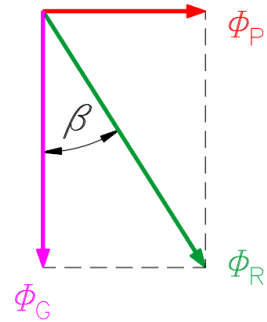
magnetno polje



polje armature - poprečno polje (opterećeni stroj)

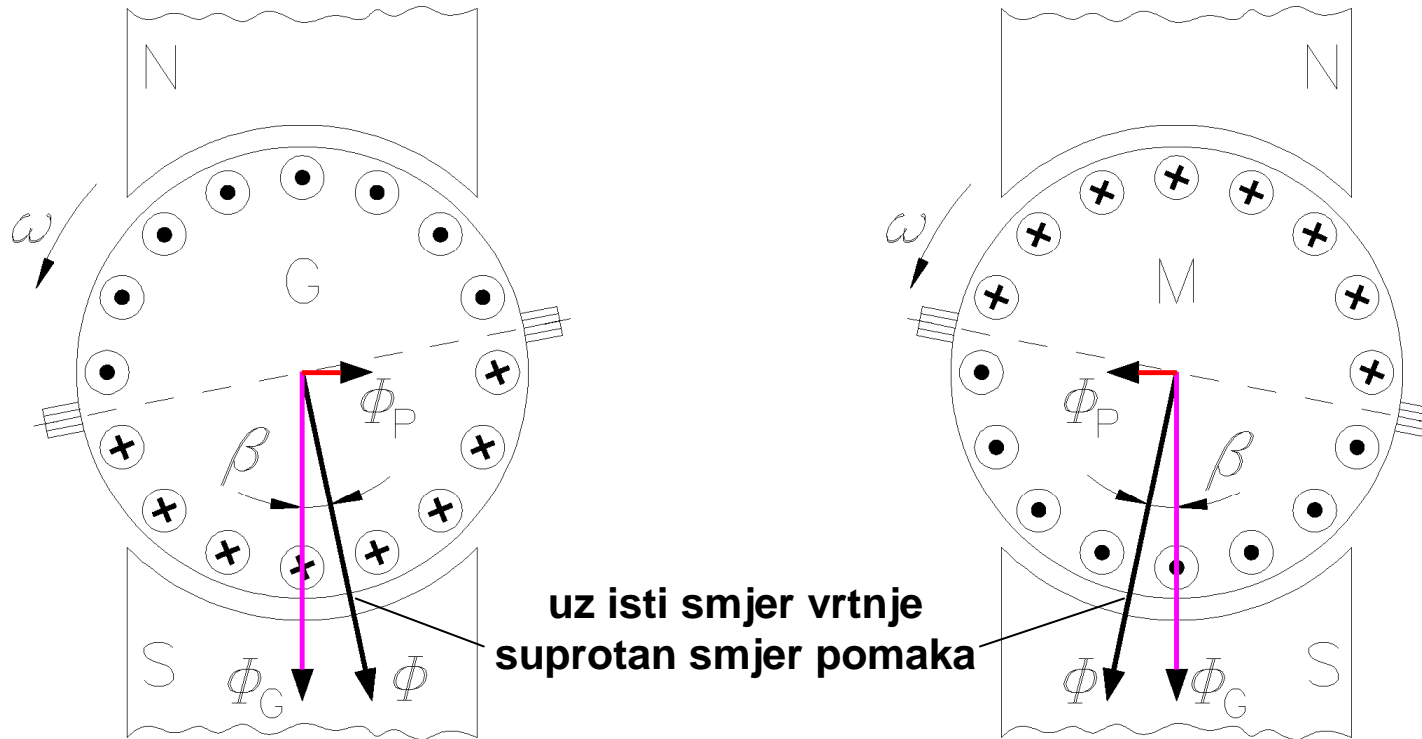


rezultirajuće polje - izobličeno (opterećeni stroj)



izobličeno polje \Rightarrow izobličenje induciranog napona u namotima armature

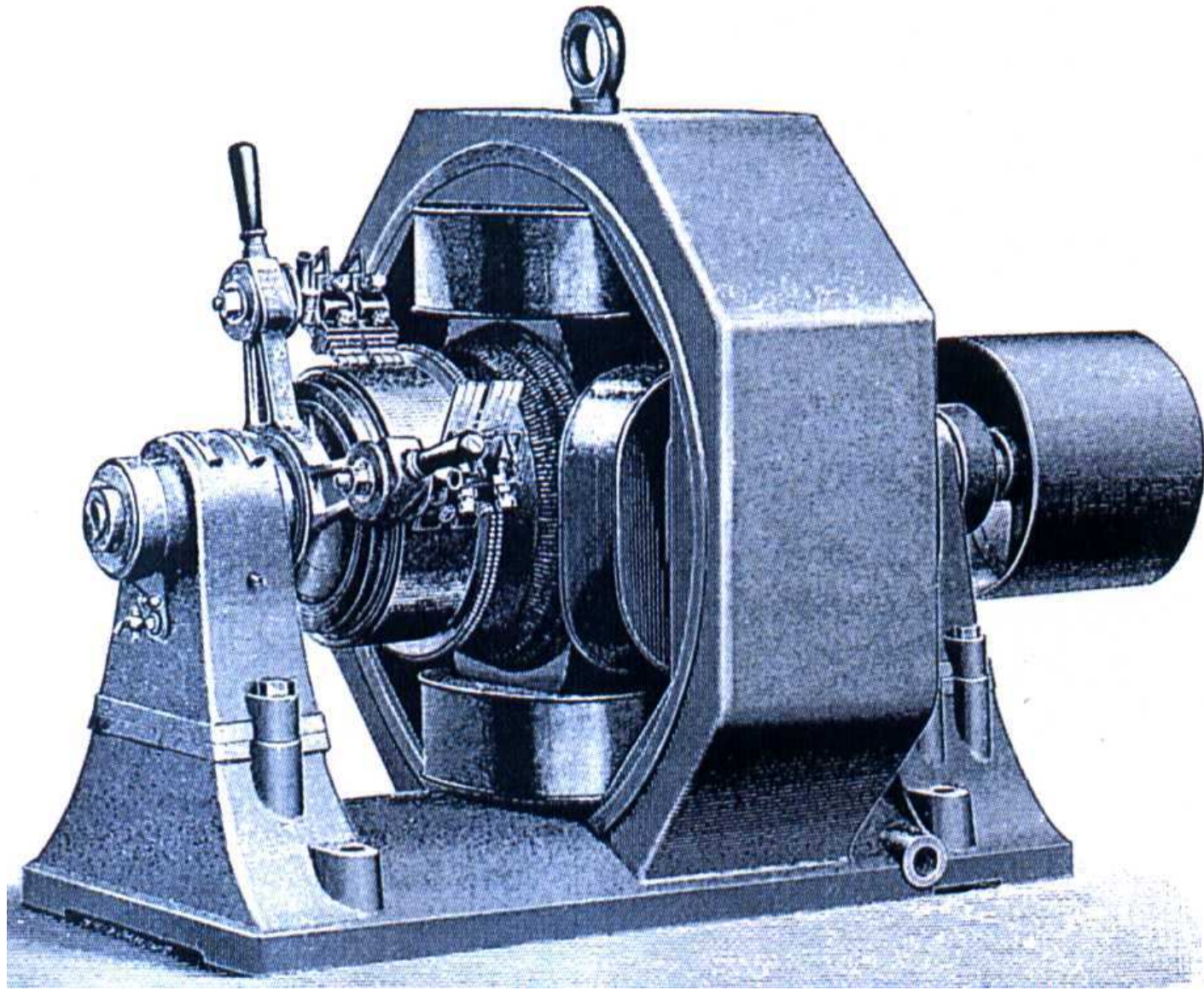
Neutralna zona



$\uparrow I_G \Rightarrow \uparrow \beta \Rightarrow \uparrow$ pomak neutralne zone

$\uparrow I_M \Rightarrow \uparrow \beta \Rightarrow \uparrow$ pomak neutralne zone

četkica izvan neutralne zone \Rightarrow jaće iskrenje, brže trošenje



Kompensacija reakcije armature

