Influienta energetica a strategiilor de comanda

Posibilitati de comanda a motorului de inductie

- U/f constant
- U/√f constant
- Fluxul statoric constant
- Fluxul rotoric constant
- Fluxul de magnetizare constant
- Frecventa rotorica constanta

Expresiile fluxurilor in functie de parametrii

Ecuatiile fazoriale in ipoteza neglijarii pierderilor in fier

$$\underline{U} = \left(R_s + jX_{s\sigma}\right)\underline{I}_s + jX_m\underline{I}_m$$

$$0 = \left(\frac{R_R}{s} + jX_{R\sigma}\right)\underline{I}_R + jX_m\underline{I}_m$$

$$\underline{I}_m = \underline{I}_S + \underline{I}_R$$

Cu notatiile

$$X_S = X_m + X_{S\sigma}$$

$$X_R = X_m + X_{R\sigma}$$

$$\sigma = 1 - \frac{X_m^2}{X_S X_R}$$

Expresiile curentilor

$$I_S = U \sqrt{\frac{\left(\frac{R_R}{s}\right)^2 + X_R^2}{\left(X_S \frac{R_R}{s} + R_S X_R\right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R\right)^2}}$$

$$I_m = U \sqrt{\frac{\left(\frac{R_R}{s}\right)^2 + X_{R\sigma}^2}{\left(X_S \frac{R_R}{s} + R_S X_R\right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R\right)^2}}$$

$$I_R = U \frac{X_m}{\sqrt{\left(X_S \frac{R_R}{s} + R_S X_R\right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R\right)^2}}$$

Relatii dintre curenti

$$\underline{I}_S = \frac{-X_R + j\dfrac{R_R}{s}}{X_m}\underline{I}_R$$

$$I_S = \frac{\sqrt{X_R^2 + \left(\dfrac{R_R}{s}\right)^2}}{X_m} I_R$$

$$\underline{I}_m = \frac{-X_{R\sigma} + j\dfrac{R_R}{s}}{X_m}\underline{I}_R$$

$$I_m = \frac{\sqrt{X_{R\sigma}^2 + \left(\dfrac{R_R}{s}\right)^2}}{X_m} I_R$$

Expresiile fluxurilor

$$\underline{\Psi}_S = L_S \underline{I}_S + L_m \underline{I}_R$$

$$\psi_S = \frac{U}{\omega_S} \sqrt{\frac{(\sigma X_S X_R)^2 + \left(X_S \frac{R_R}{s} \right)^2}{\left(X_S \frac{R_R}{s} + R_S X_R \right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R \right)^2}}$$

$$\psi_m = U \cdot L_m \sqrt{\frac{(X_{R\sigma})^2 + \left(\frac{R_R}{s} \right)^2}{\left(X_S \frac{R_R}{s} + R_S X_R \right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R \right)^2}}$$

$$\psi_R = U \cdot L_m \frac{\frac{R_R}{s}}{\sqrt{\left(X_S \frac{R_R}{s} + R_S X_R \right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R \right)^2}}$$

Expresiile cuplului

$$C = \frac{3p}{\omega_S} U^2 \frac{X_m^2 \frac{R_R}{s}}{\left(X_S \frac{R_R}{s} + R_S X_R \right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R \right)^2}$$

$$s_k = R_R \sqrt{\frac{R_S^2 + X_S^2}{(\sigma X_S X_R)^2 + R_S^2 X_R^2}}$$

$$C_k = \frac{3p}{2\omega_S} \frac{X_m^2 U^2}{\sqrt{\left((\sigma X_S X_R)^2 + R_S^2 X_R^2\right)\left(R_S^2 + X_S^2\right)} + R_S X_m^2}$$

Indicatori de calitate energetica

Puterea aparenta relativa S / S_N

Puterea activa relativa P / P_N

Curentul relativ absorbit I_S / I_N

Factorul de putere $\cos\varphi$

Randamentul electric η_e

Puterea aparenta relativa

$$S = 3 \cdot U \cdot I_S = 3 \cdot U^2 \sqrt{\frac{\left(\frac{R_R}{s}\right)^2 + X_R^2}{\left(X_S \frac{R_R}{s} + R_S X_R\right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R\right)^2}}$$

$$\frac{S}{S_N} = \frac{\sqrt{3} \cdot U^2}{U_N I_N} \sqrt{\frac{\left(\frac{R_R}{s}\right)^2 + X_R^2}{\left(X_S \frac{R_R}{s} + R_S X_R\right)^2 + \left(R_S \frac{R_R}{s} + \sigma X_S X_R\right)^2}}$$

Factorul de putere

Se exprima din schema echivalenta in T a masinii

$$R_e = R_S + \frac{R_R}{s}\frac{X_m^2}{\left(\frac{R_R}{s}\right)^2 + X_R^2}$$

$$X_e = X_{S\sigma} + X_m\frac{\left(\frac{R_R}{s}\right)^2 + X_{R\sigma}X_r}{\left(\frac{R_R}{s}\right)^2 + X_R^2}$$

$$\cos\varphi = \frac{R_e}{\sqrt{R_e^2 + X_e^2}}$$

Randamentul electric

Puterea activa

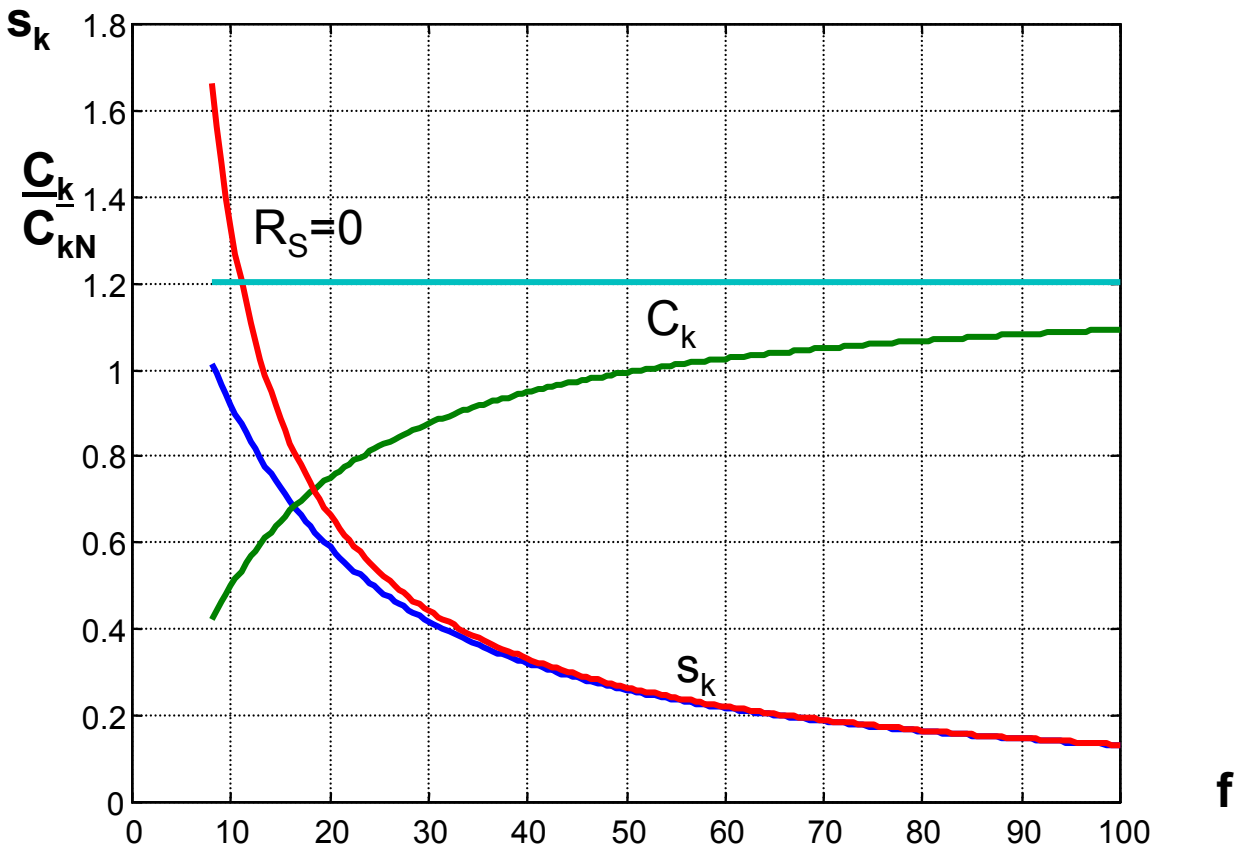
$$P = 3 \cdot U \cdot I_S \cdot \cos\varphi$$

Randamentul electric

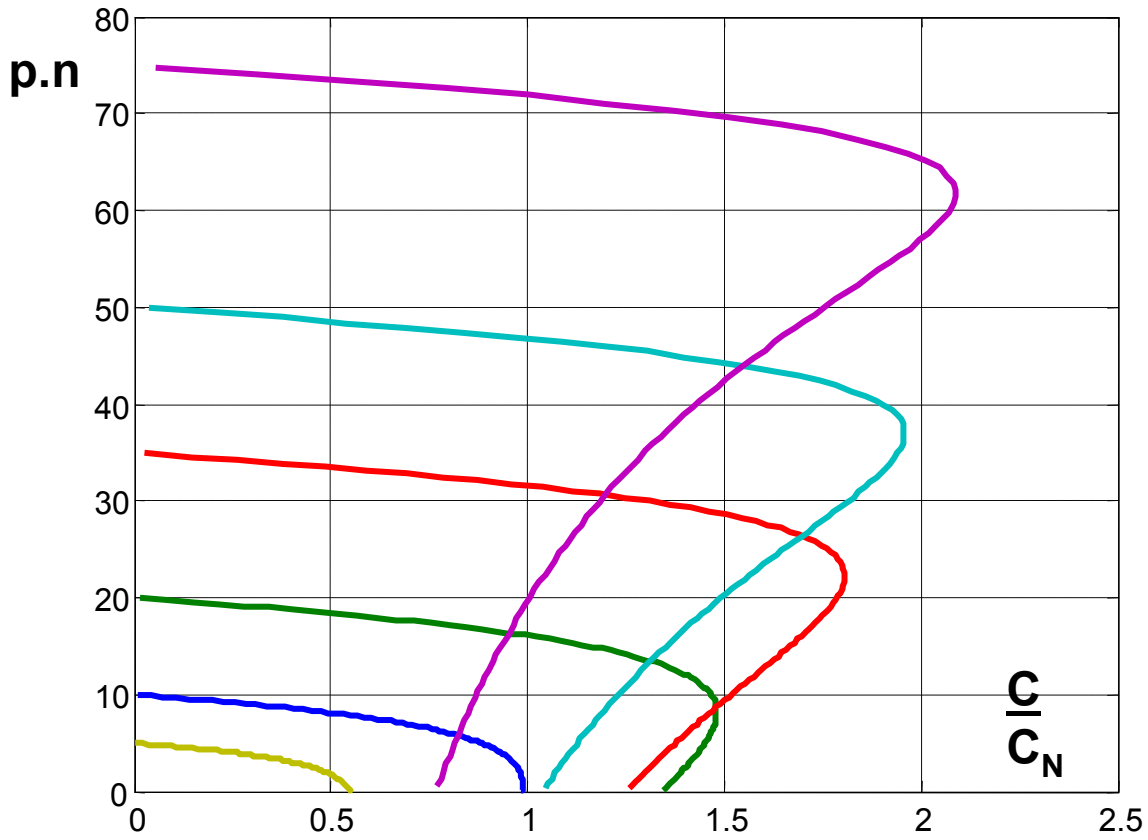
$$\eta_e = \frac{P - 3 \cdot R_S \cdot I_S^2 - 3 \cdot R_R \cdot I_R^2}{P}$$

Comanda cu U/f constant

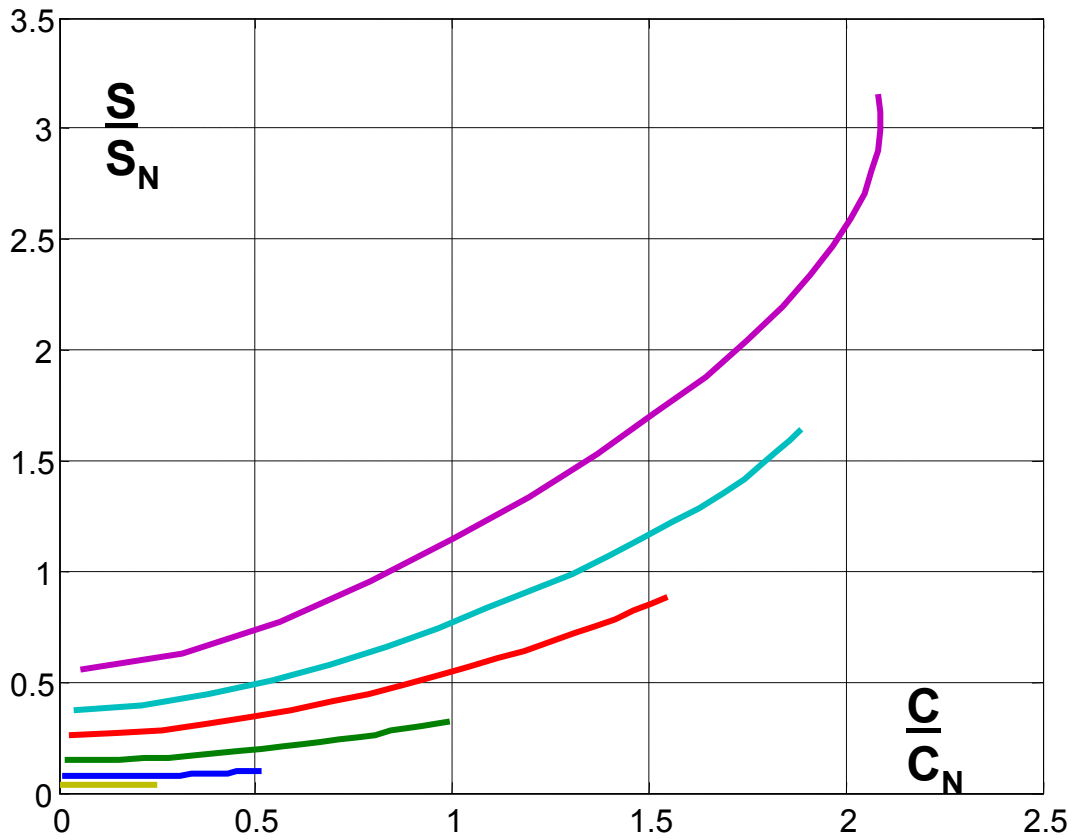
Variatia s_k si C_k cu si fara R_s in functie de frecventa



Caracteristici mecanice



Puterea aparenta relativa



5 Hz

10 Hz

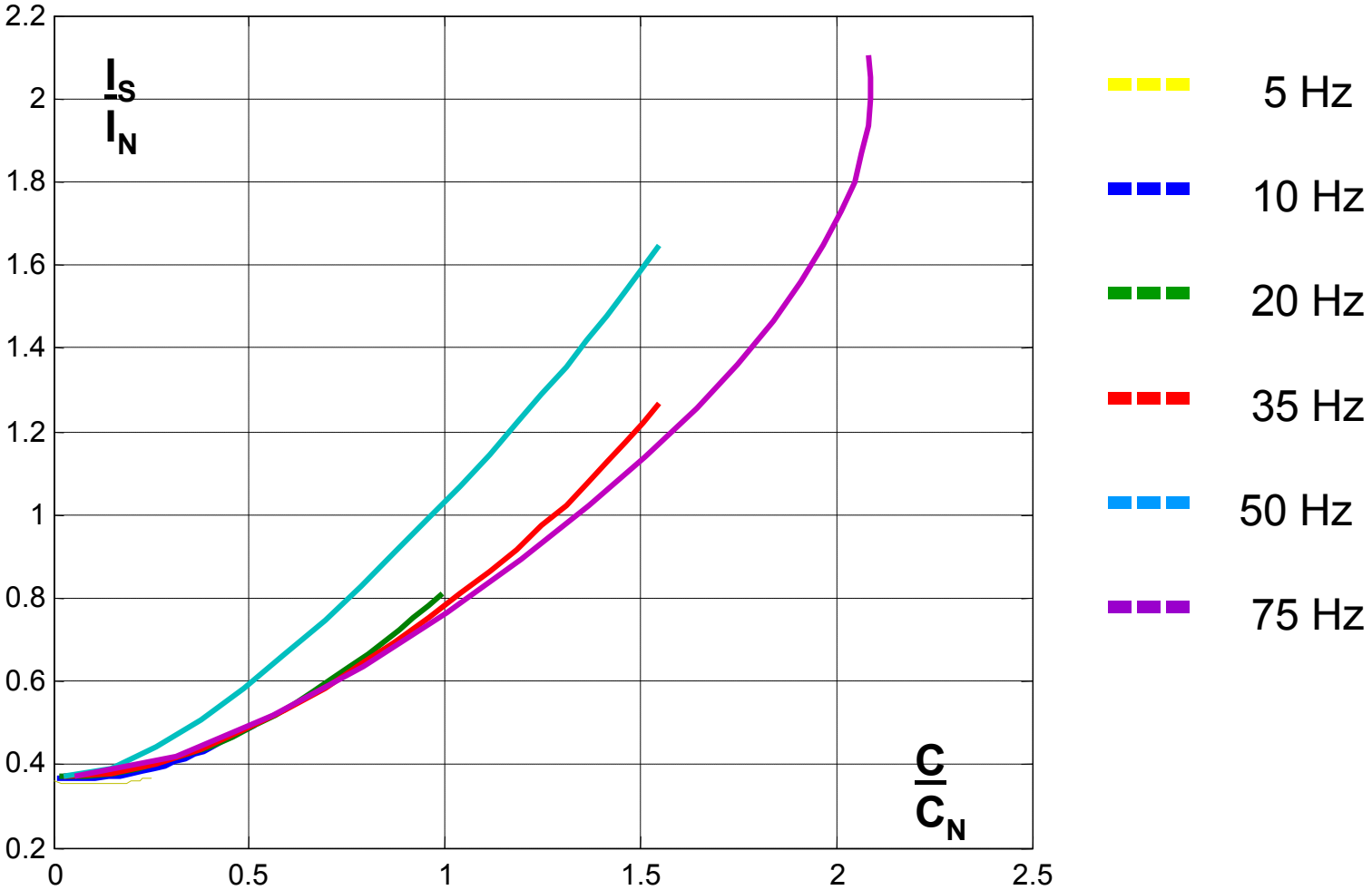
20 Hz

35 Hz

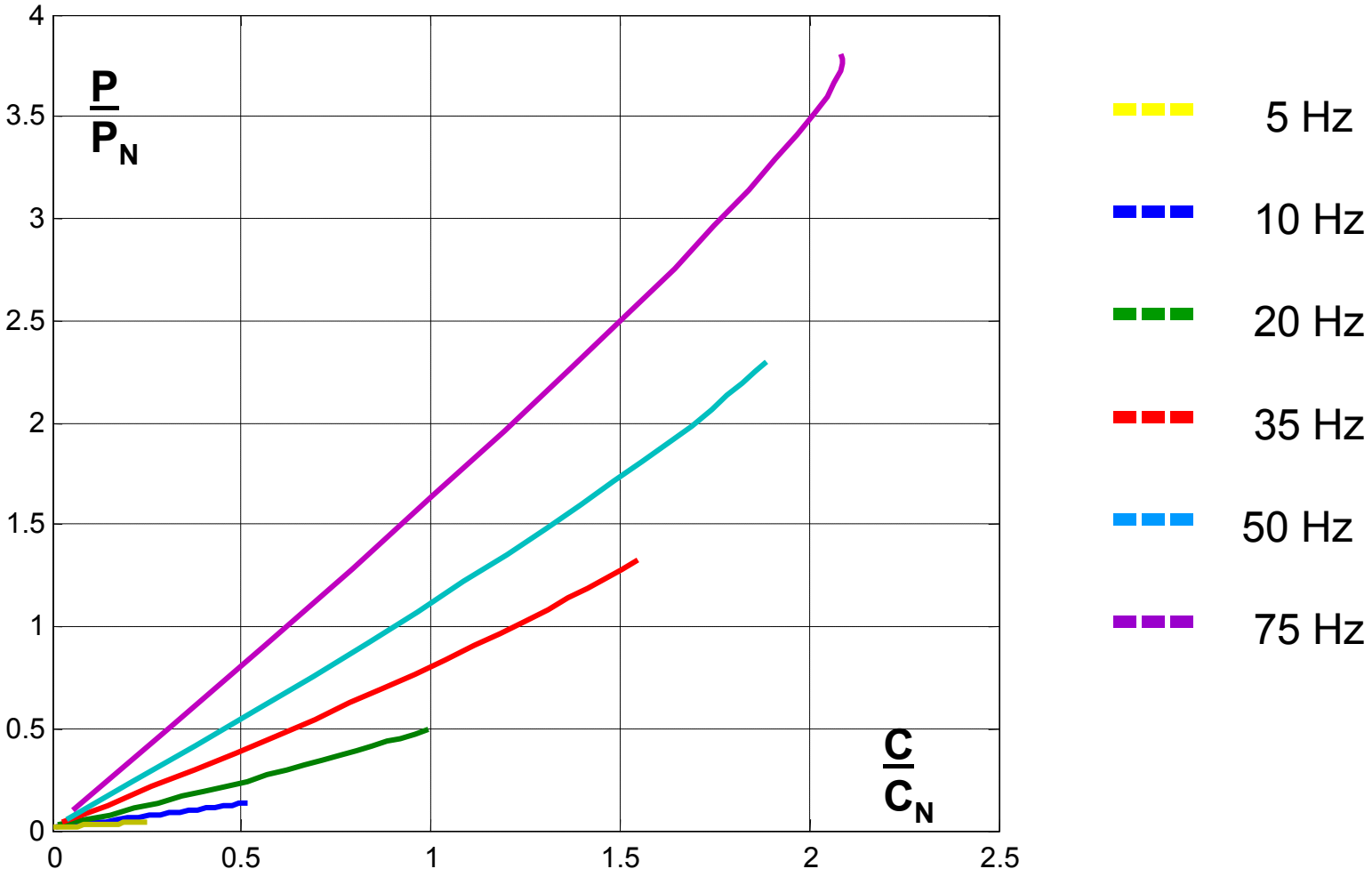
50 Hz

75 Hz

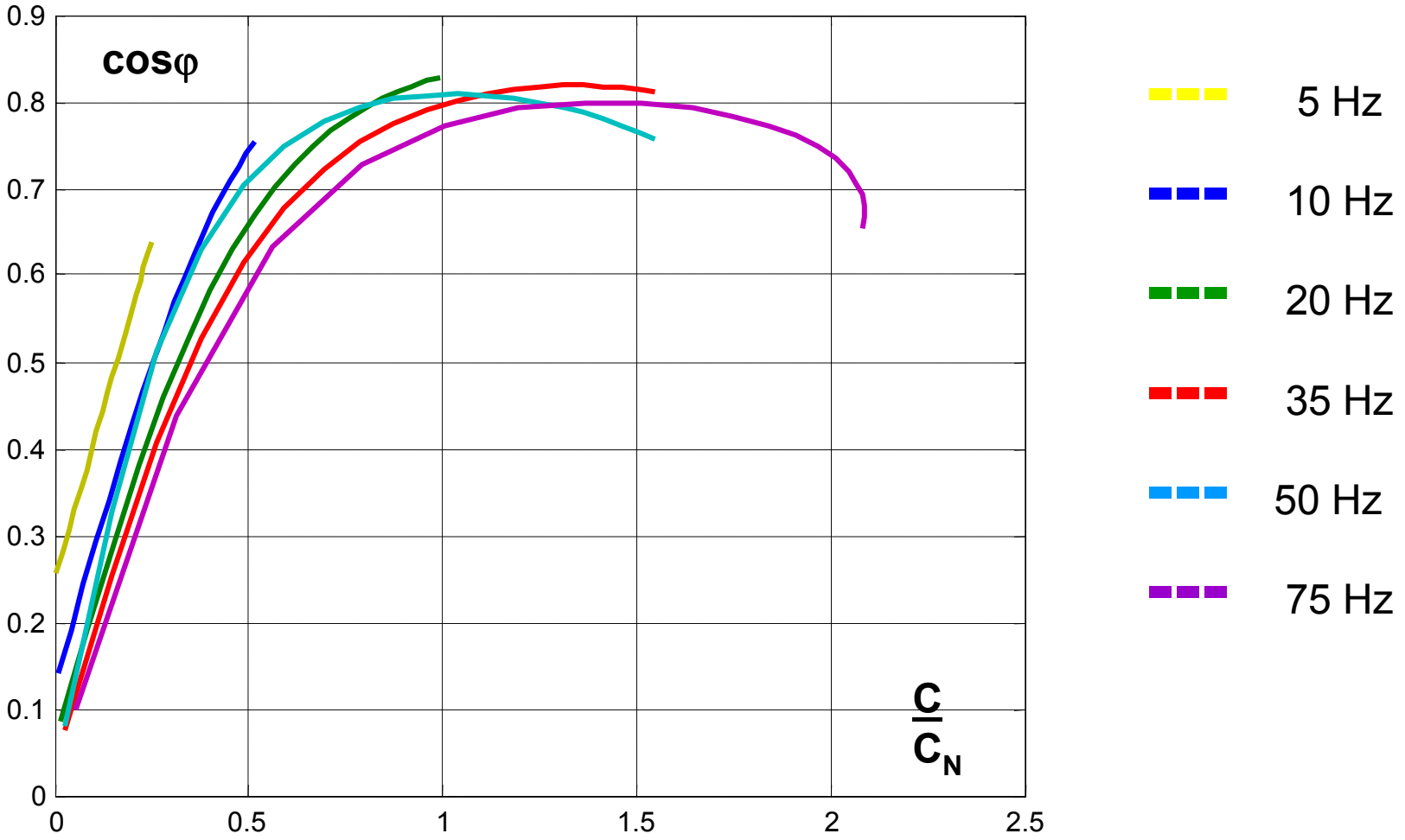
Curentul raportat



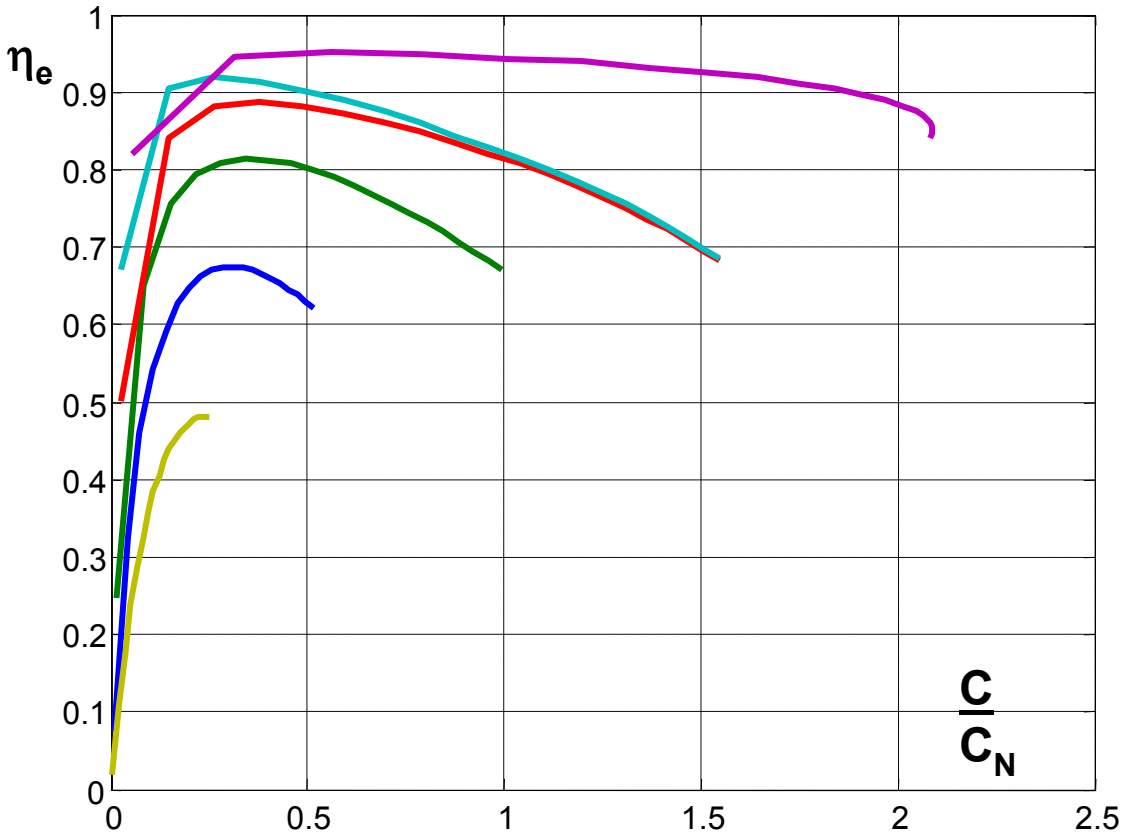
Puterea activa relativa



Factorul de putere



Randamentul electric



5 Hz

10 Hz

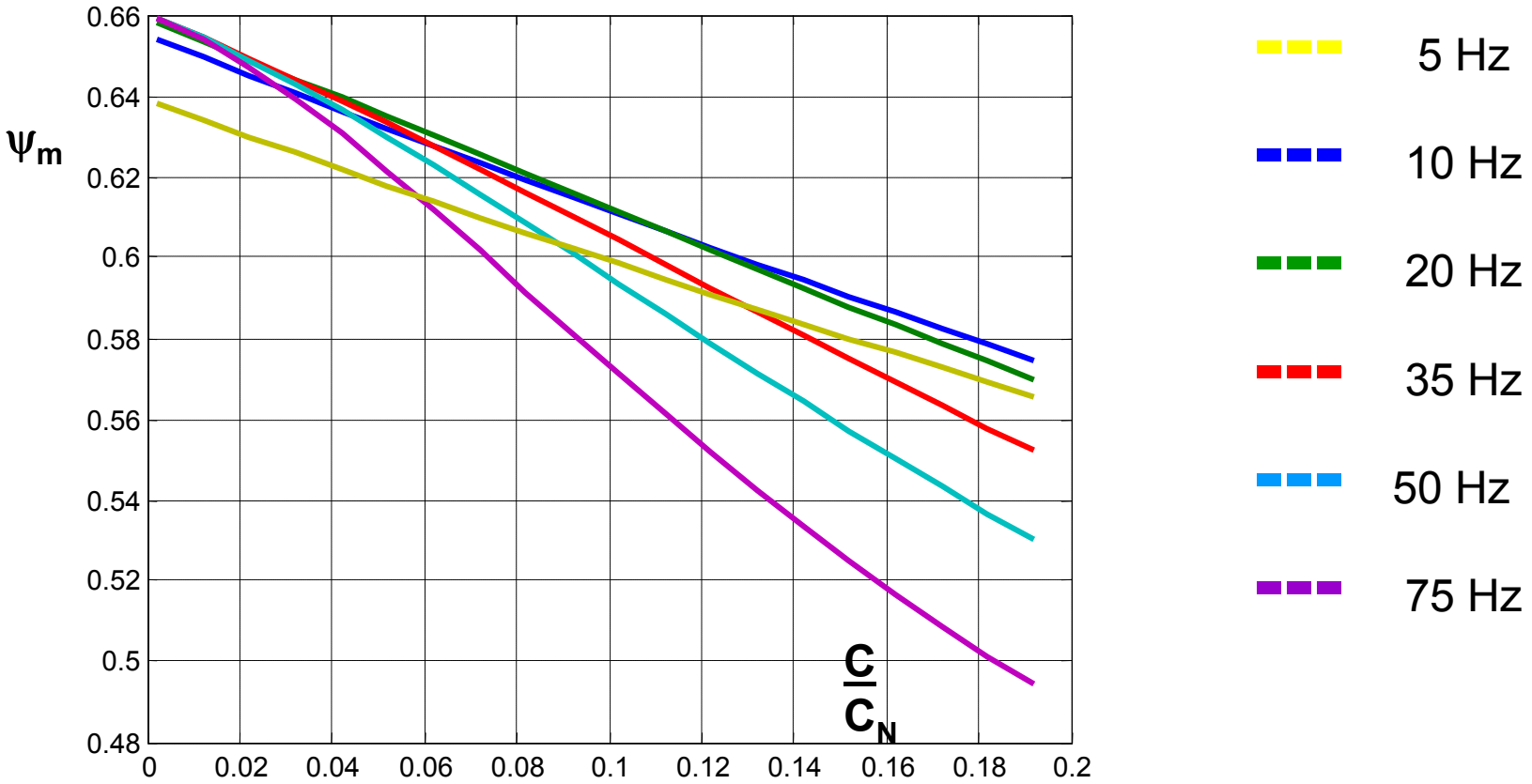
20 Hz

35 Hz

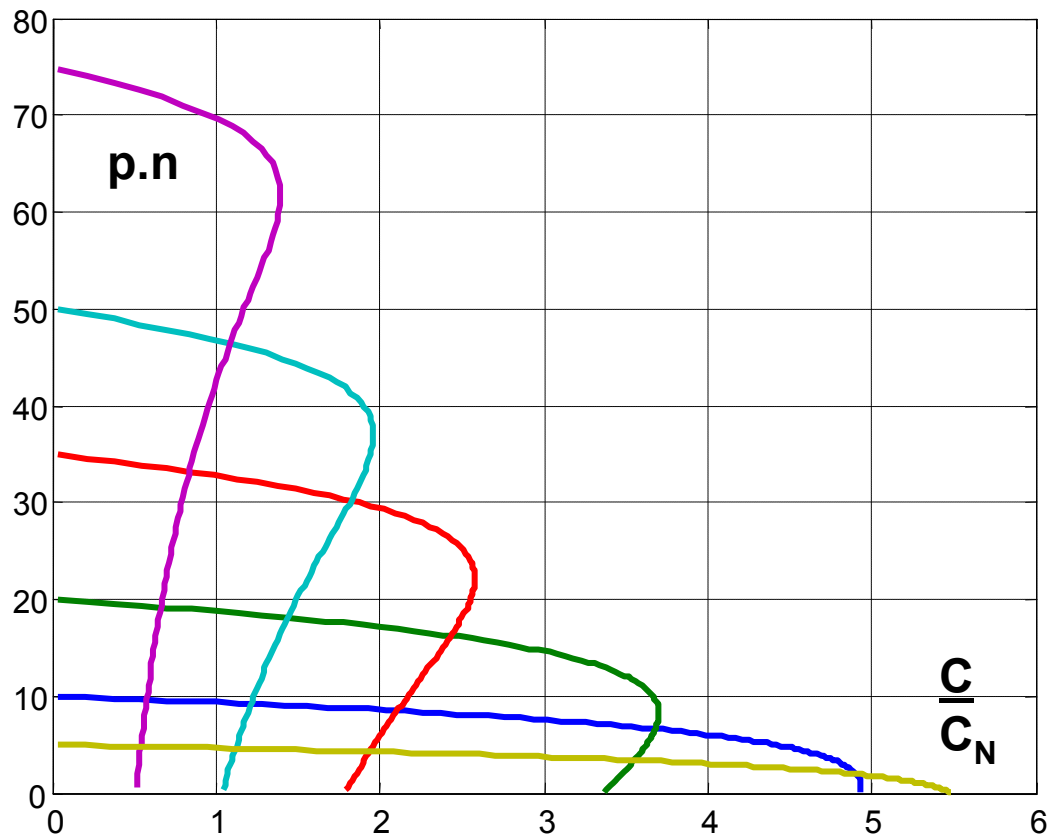
50 Hz

75 Hz

Fluxul de magnetizare



Comanda prin mentinerea constanta a raportului U/√f



5 Hz

10 Hz

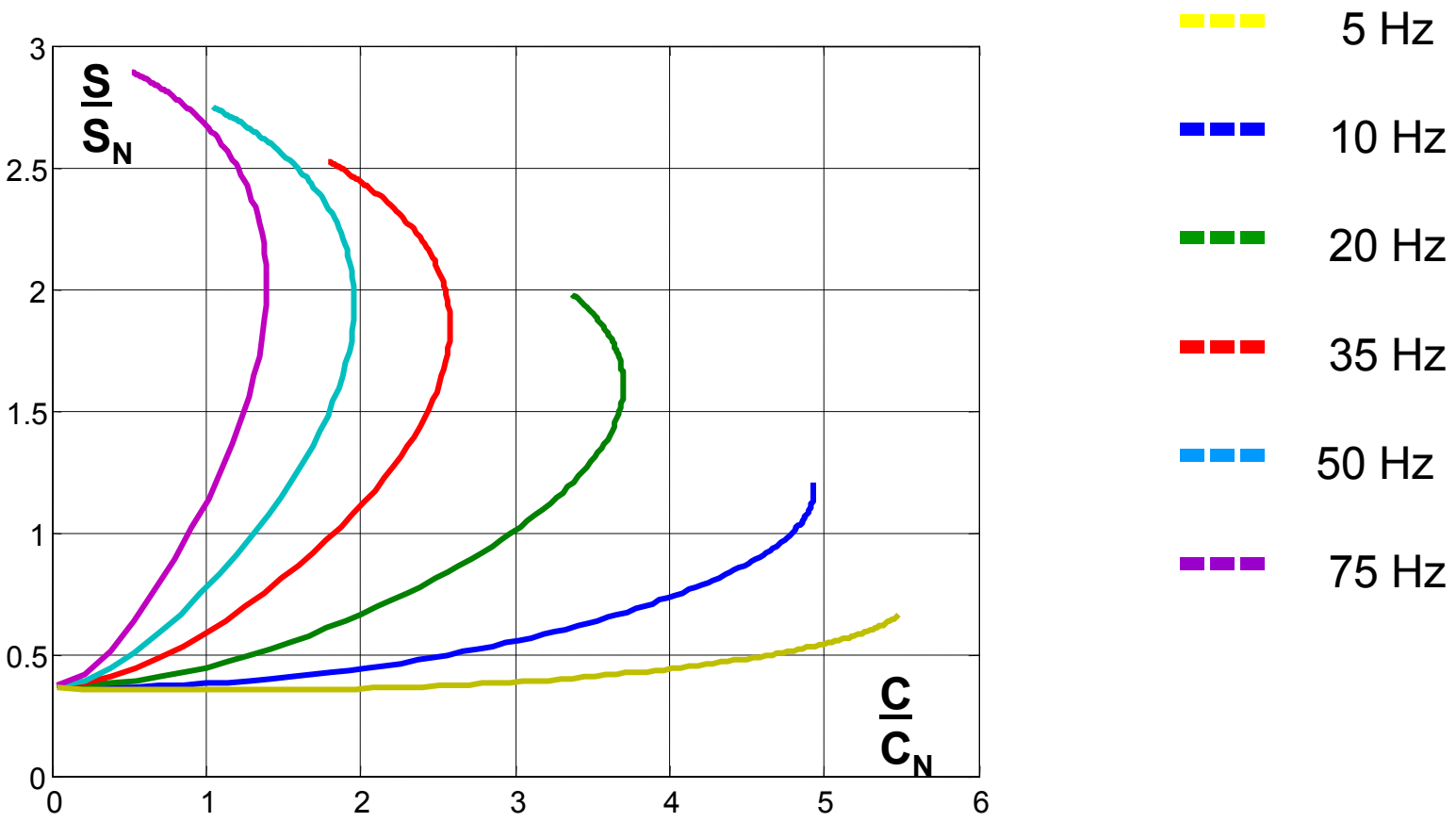
20 Hz

35 Hz

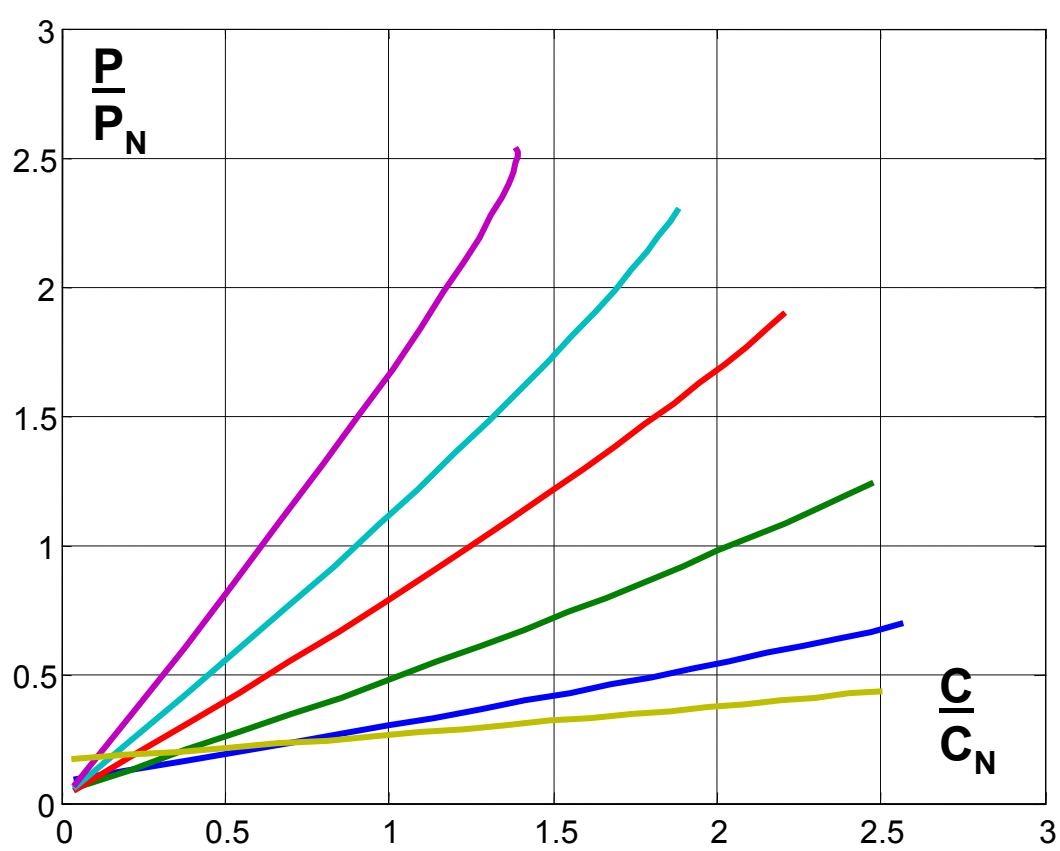
50 Hz

75 Hz

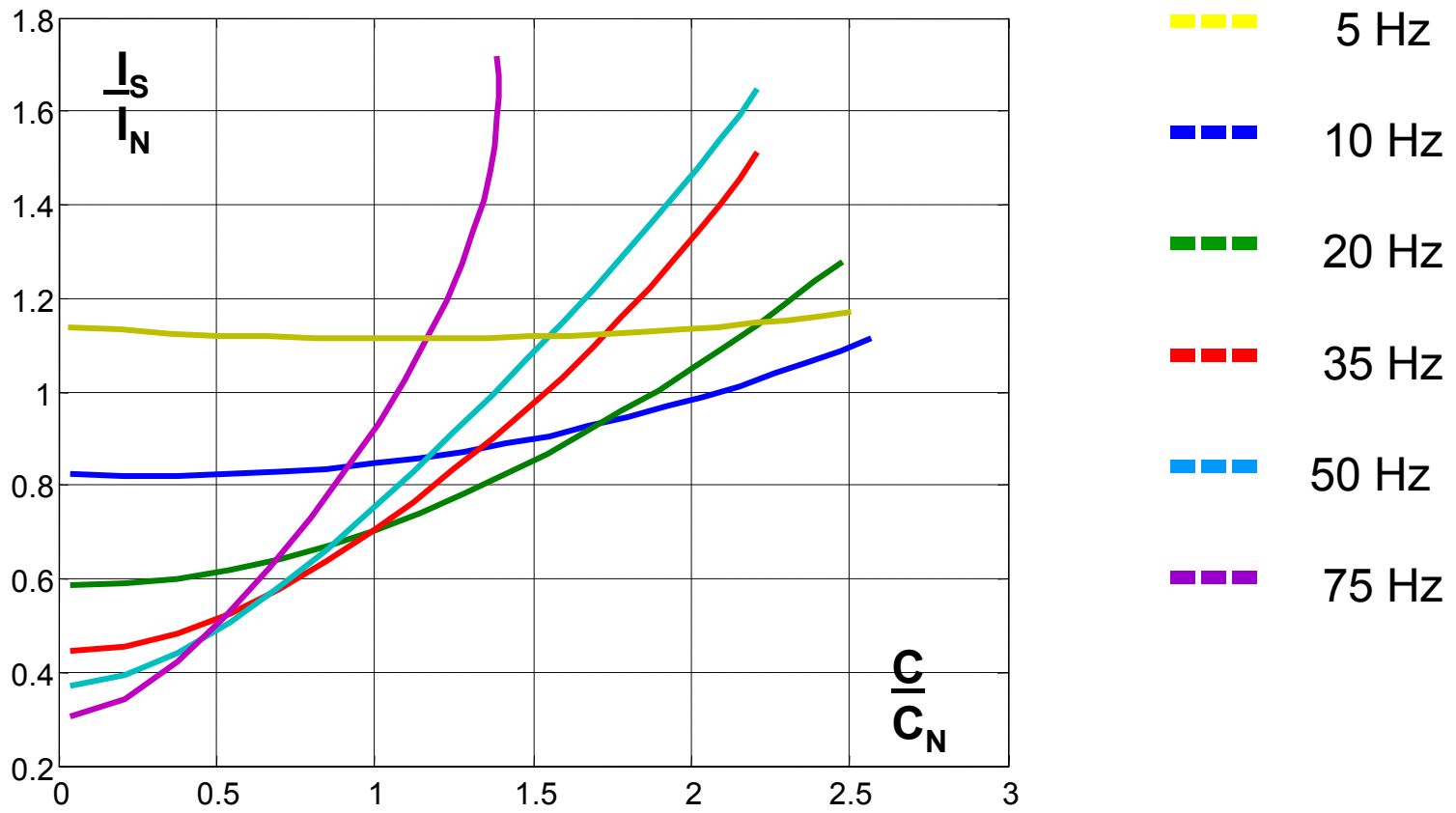
Puterea aparenta raportata



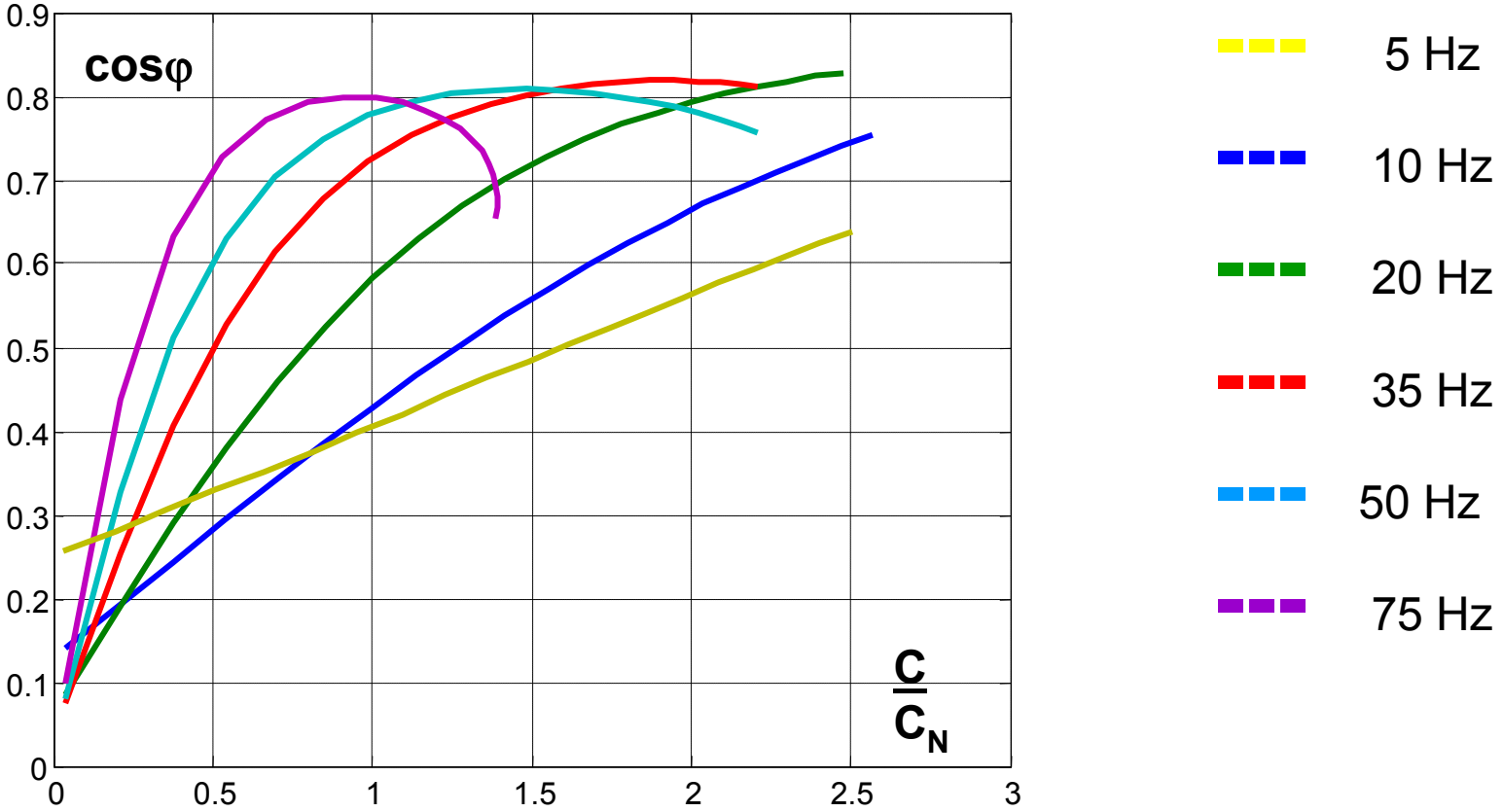
Puterea activa raportata



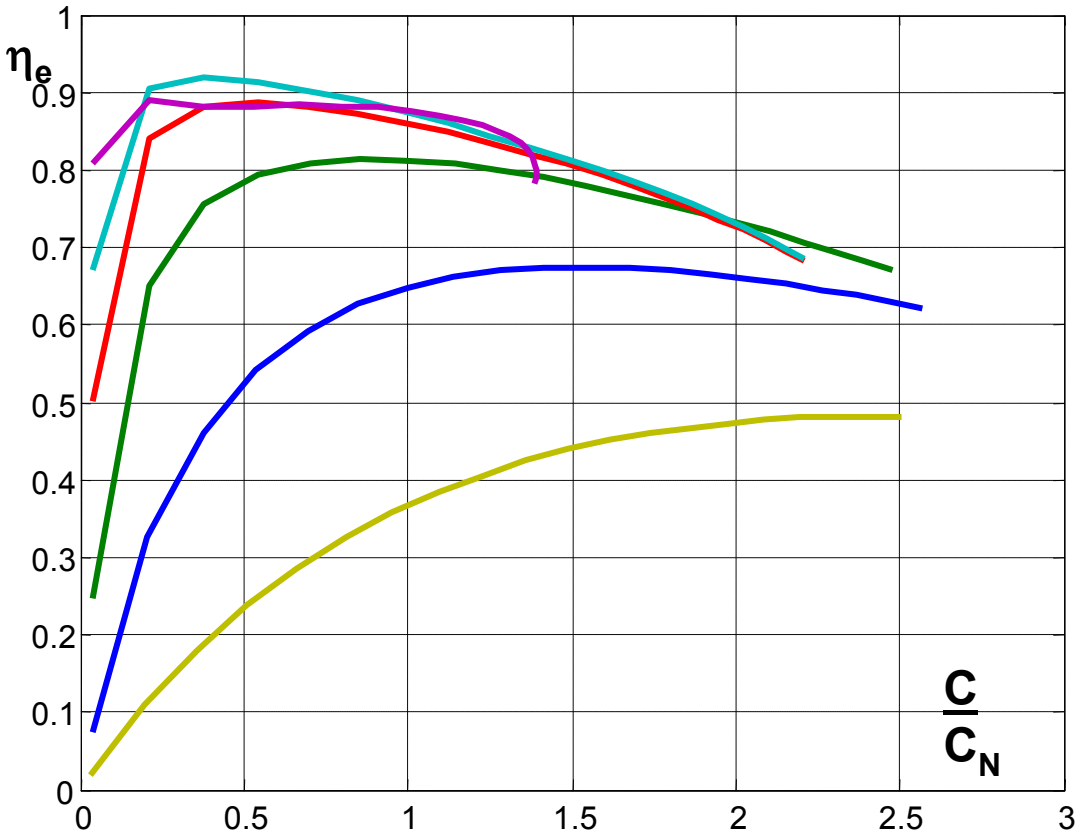
Curentul raportat



Factorul de putere



Randamentul electric



5 Hz

10 Hz

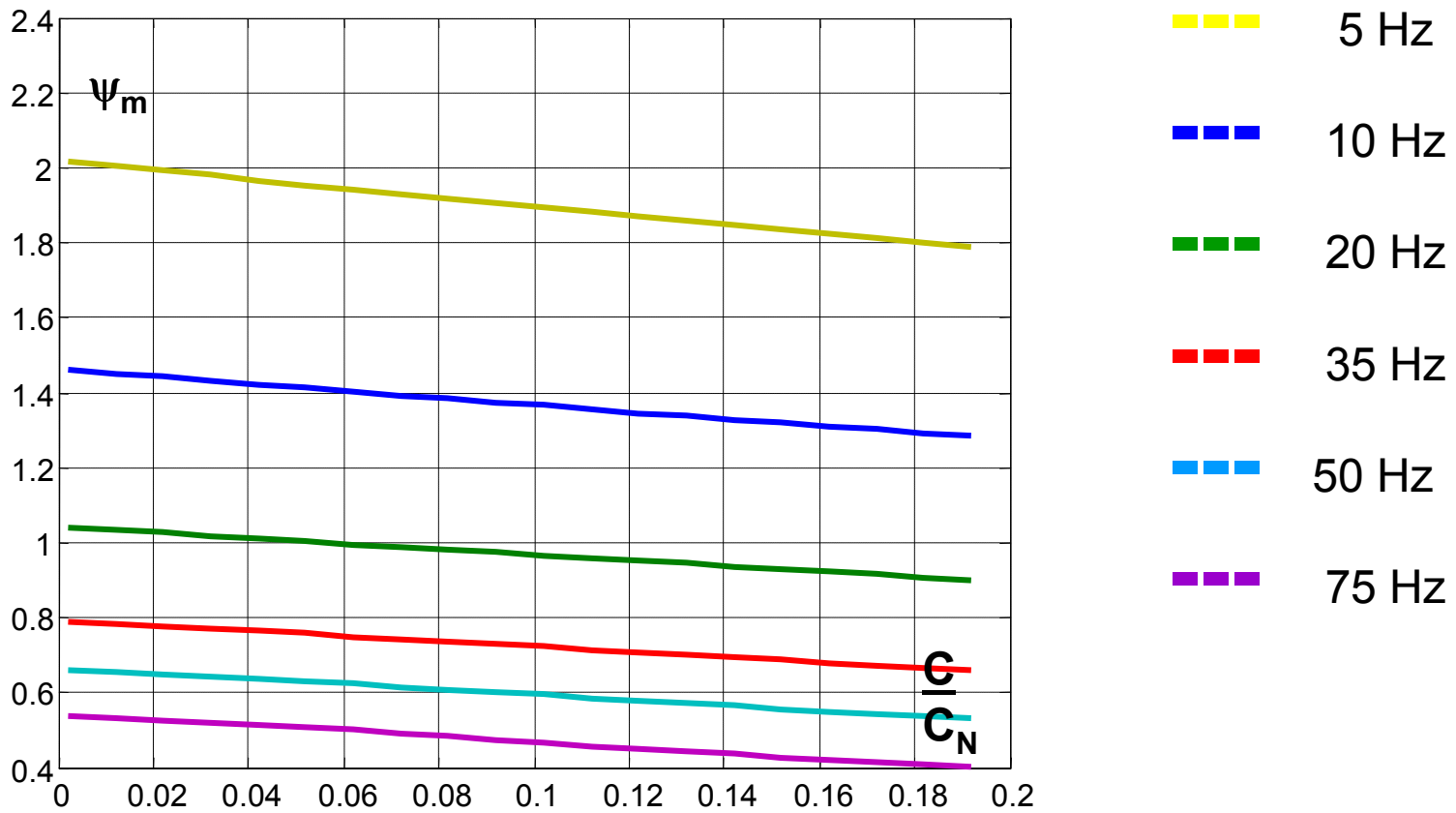
20 Hz

35 Hz

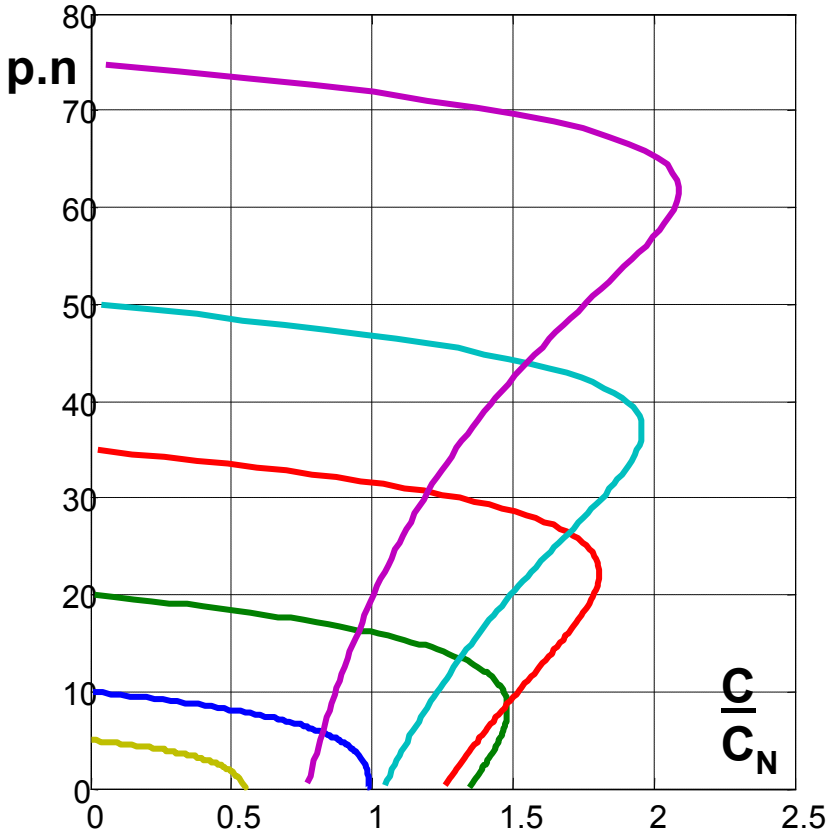
50 Hz

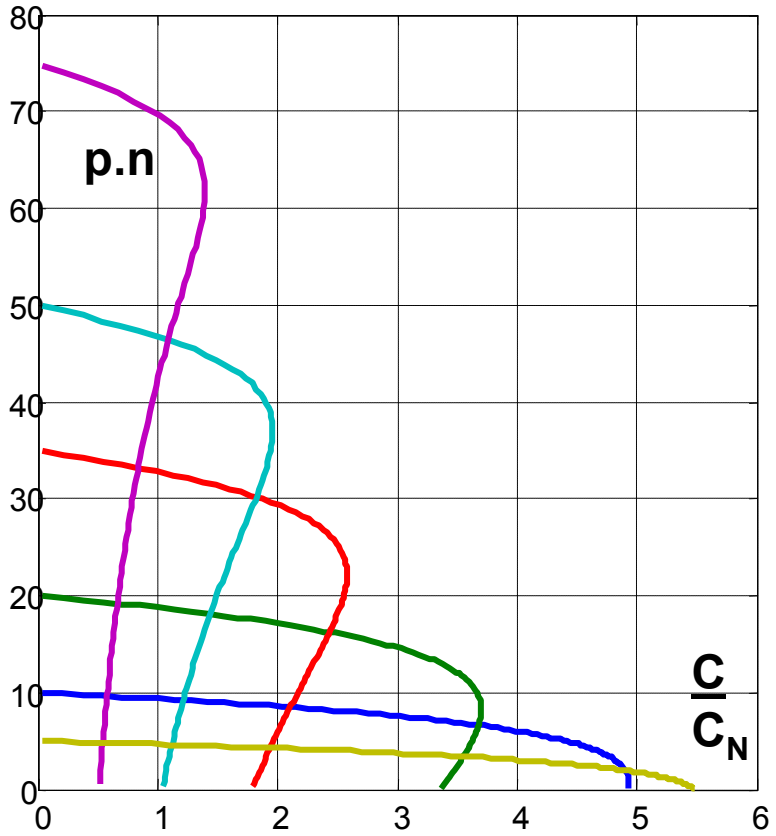
75 Hz

Fluxul de magnetizare



Comparatia celor doua metode

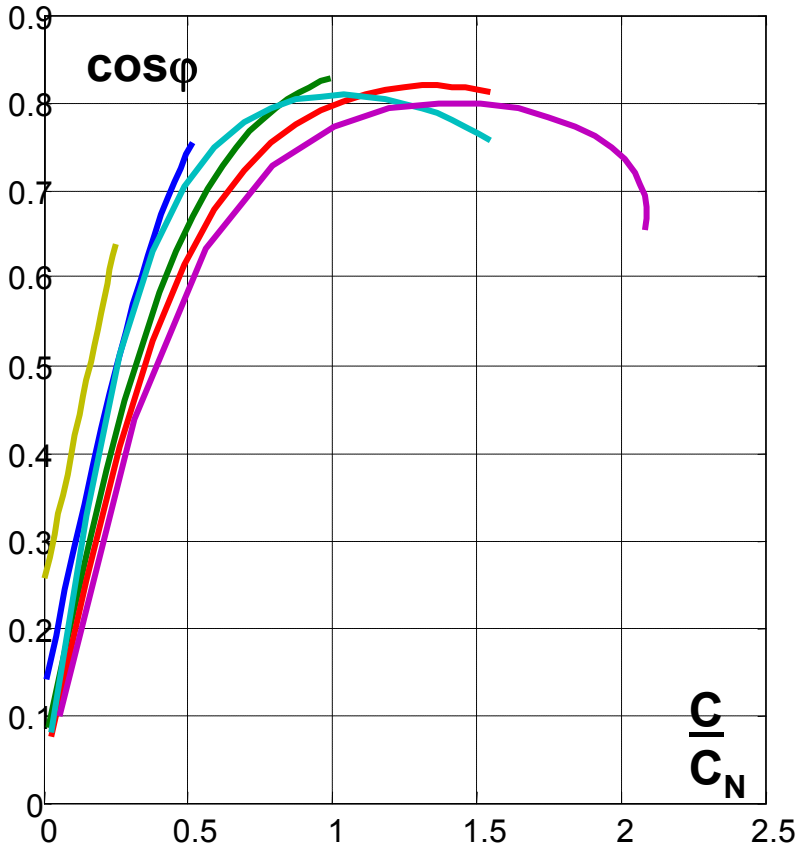


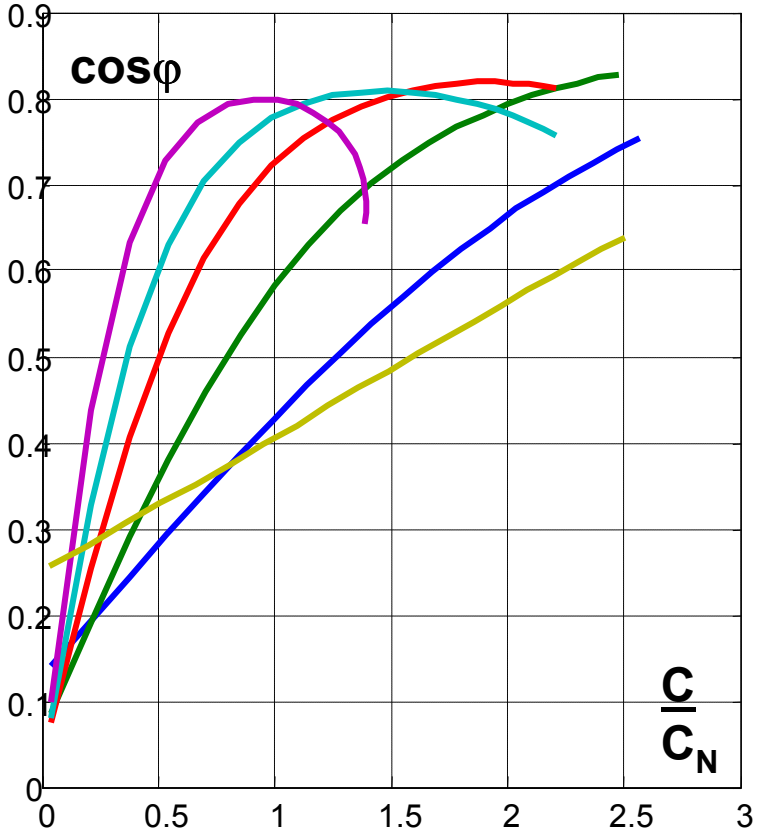


5 Hz 10 Hz 20 Hz

35 Hz 50 Hz 75 Hz

Variatia factorului de putere

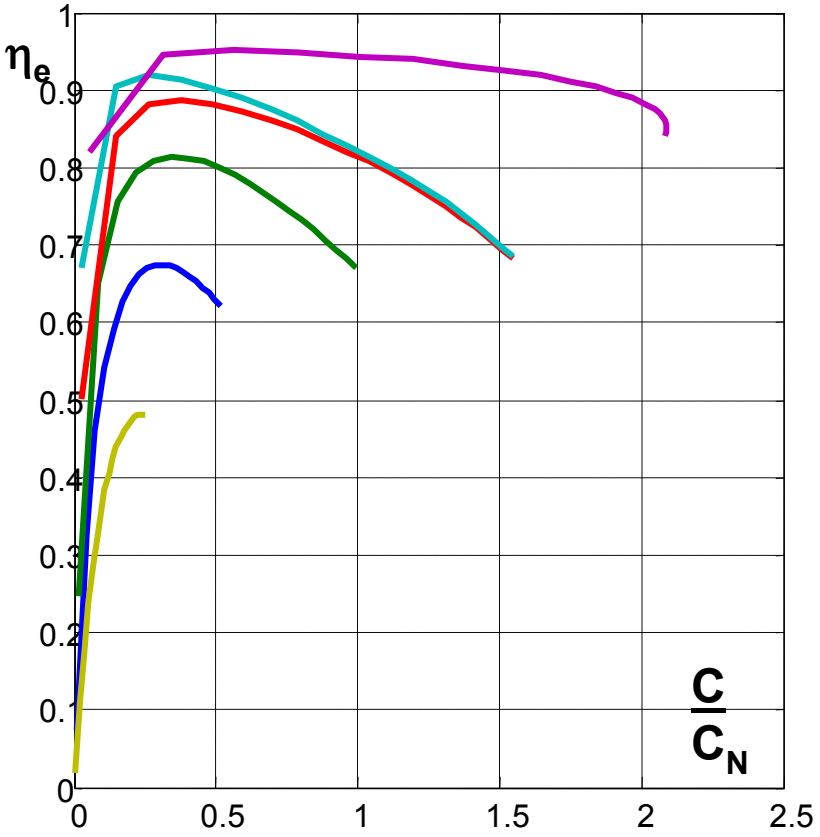


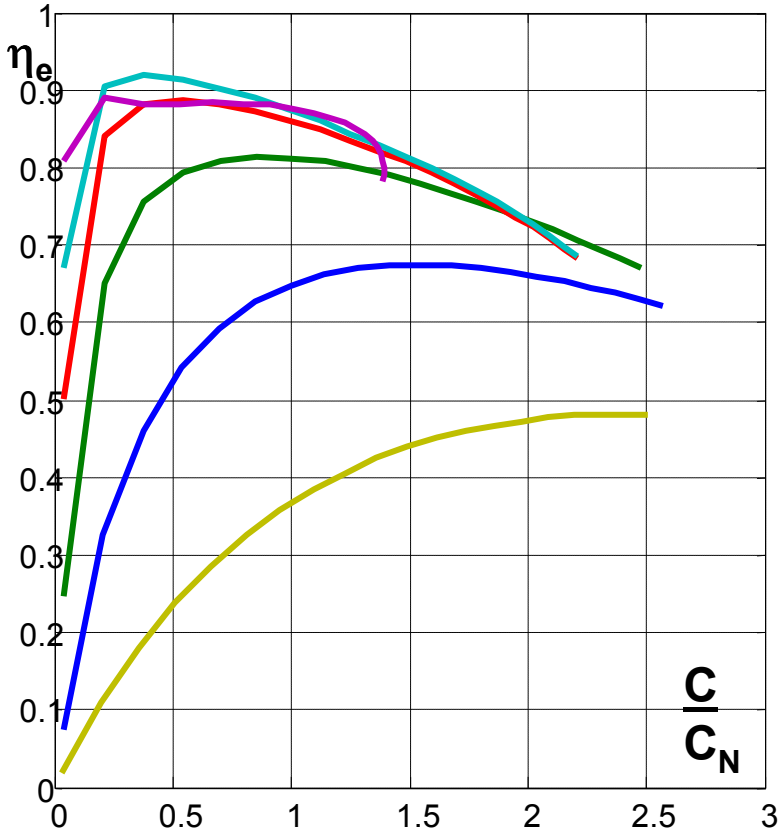


5 Hz 10 Hz 20 Hz

35 Hz 50 Hz 75 Hz

Variatia randamentului electric

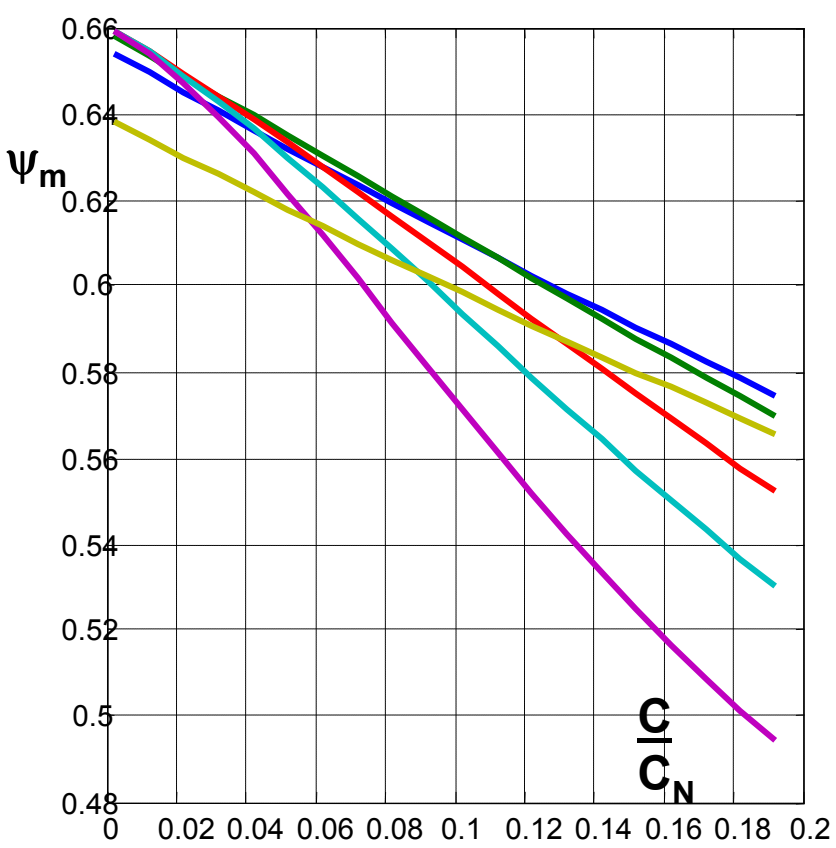


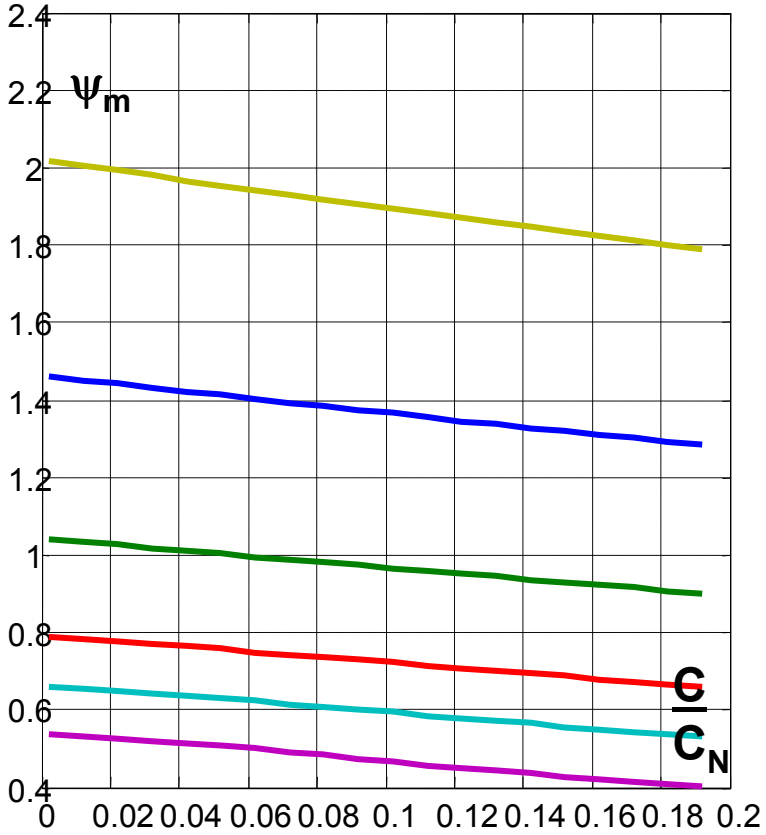


5 Hz 10 Hz 20 Hz

35 Hz 50 Hz 75 Hz

Variatia fluxului de magnetizare

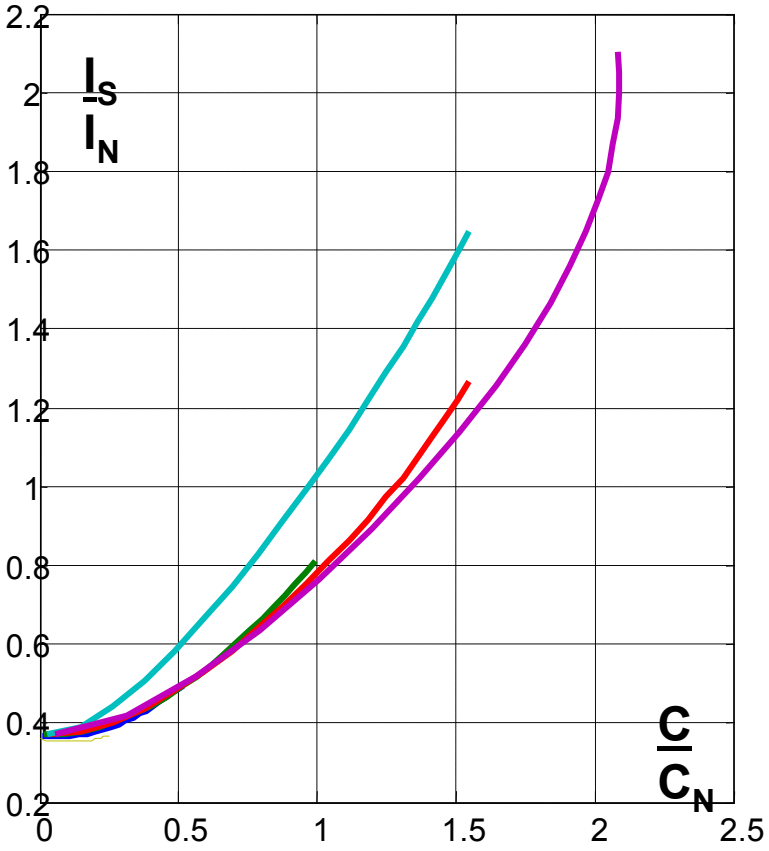


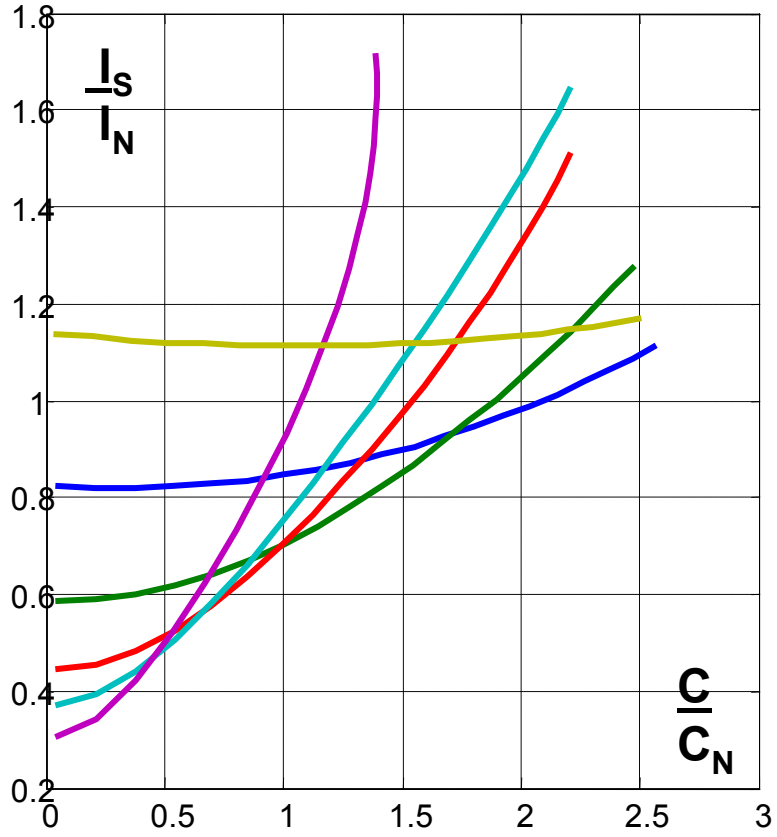


5 Hz 10 Hz 20 Hz

35 Hz 50 Hz 75 Hz

Variatia curentului

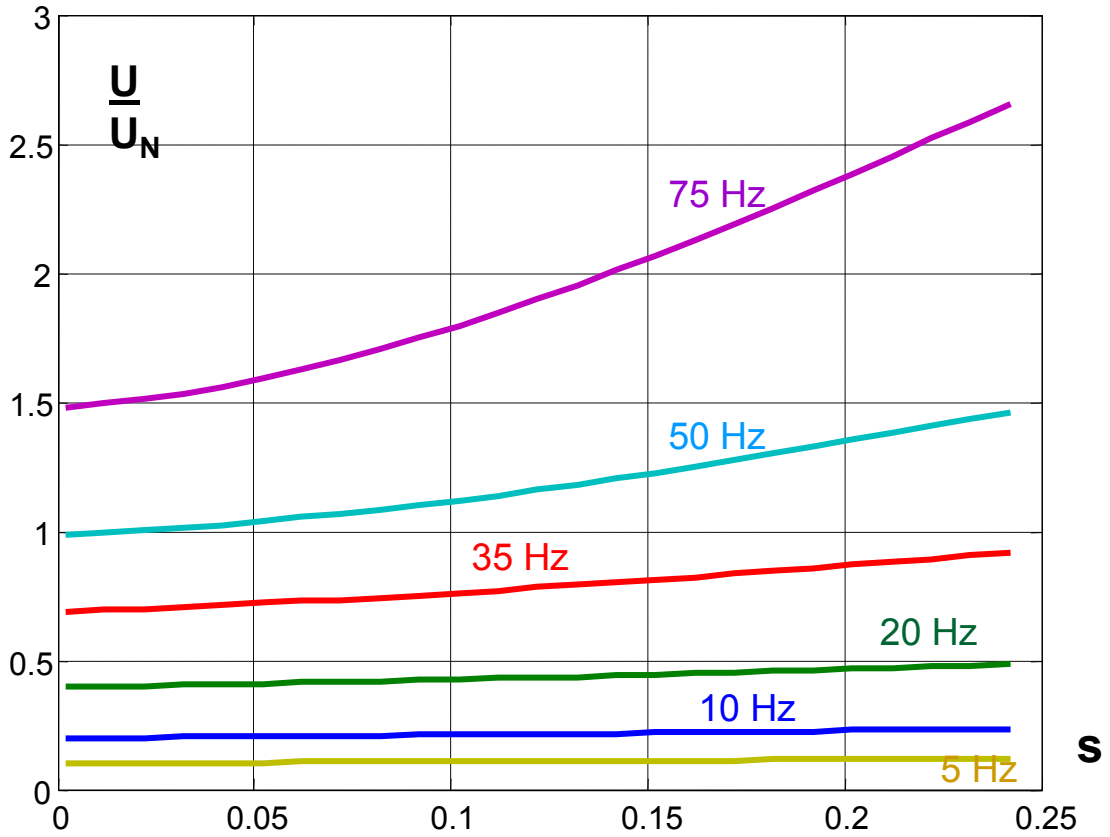




5 Hz 10 Hz 20 Hz

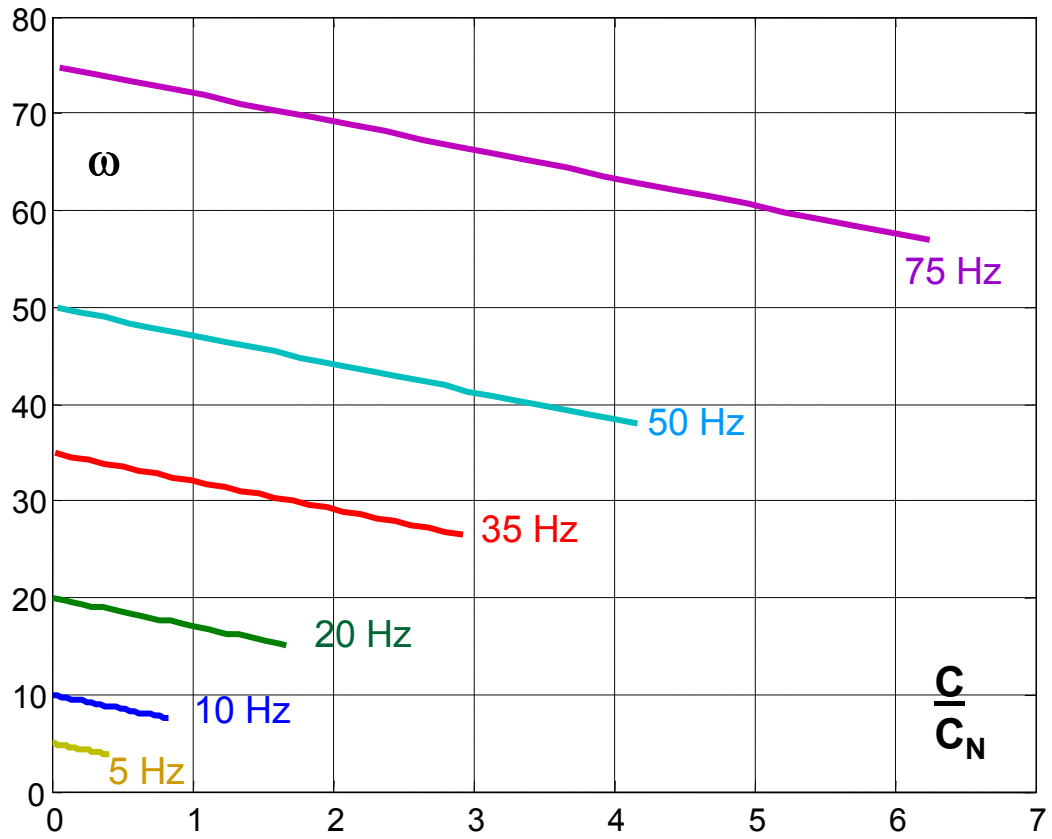
35 Hz 50 Hz 75 Hz

Comanda dupa fluxul rotoric



Comanda dupa fluxul rotoric

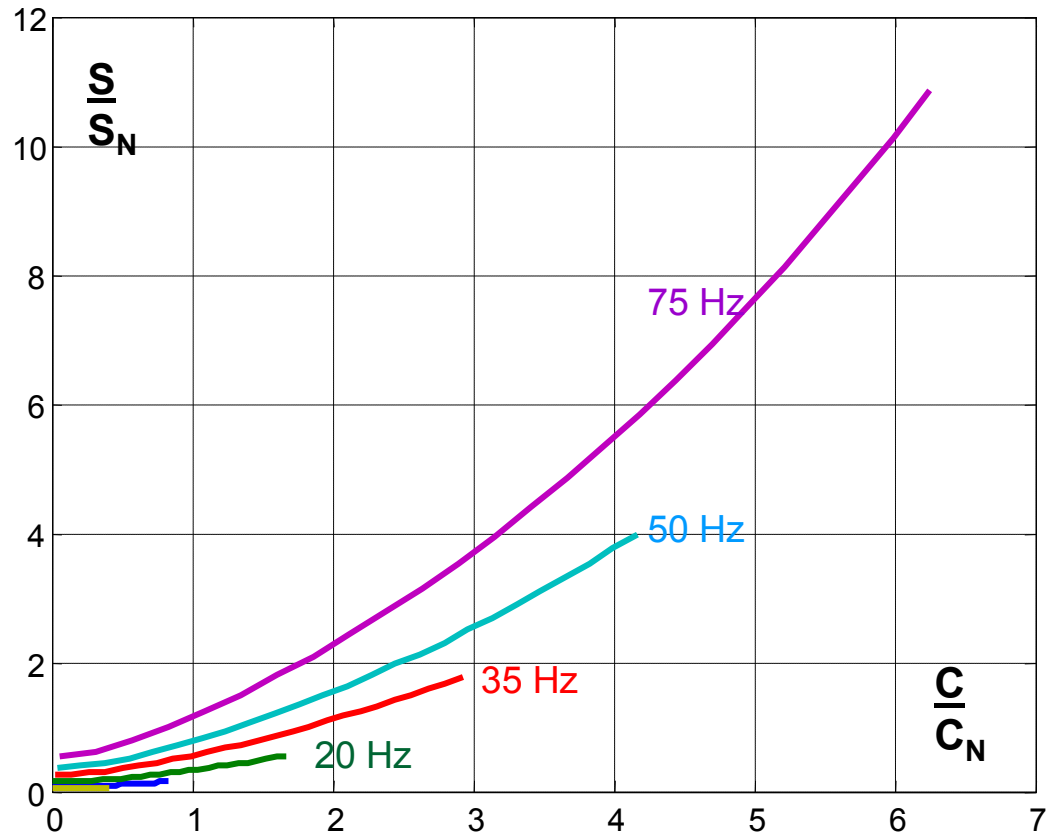
$s_{max}=0.25$



Comanda dupa fluxul rotoric

5 Hz

10 Hz



Comanda dupa fluxul rotoric

5 Hz

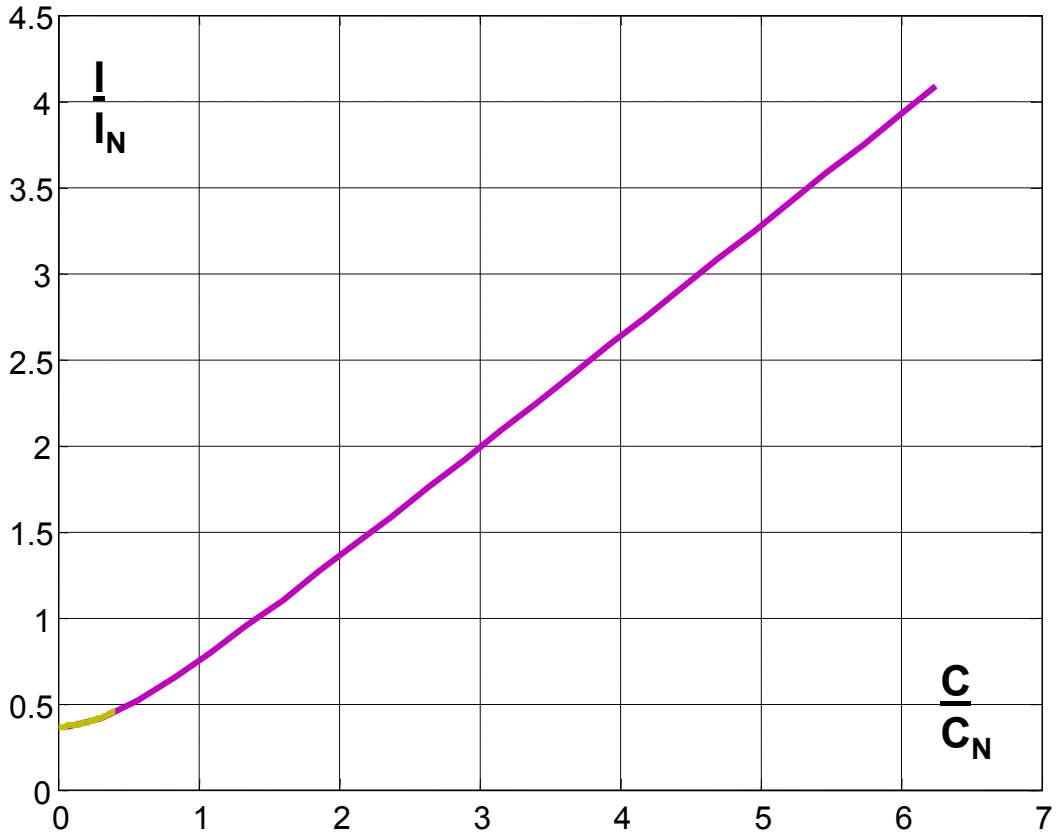
10 Hz

20 Hz

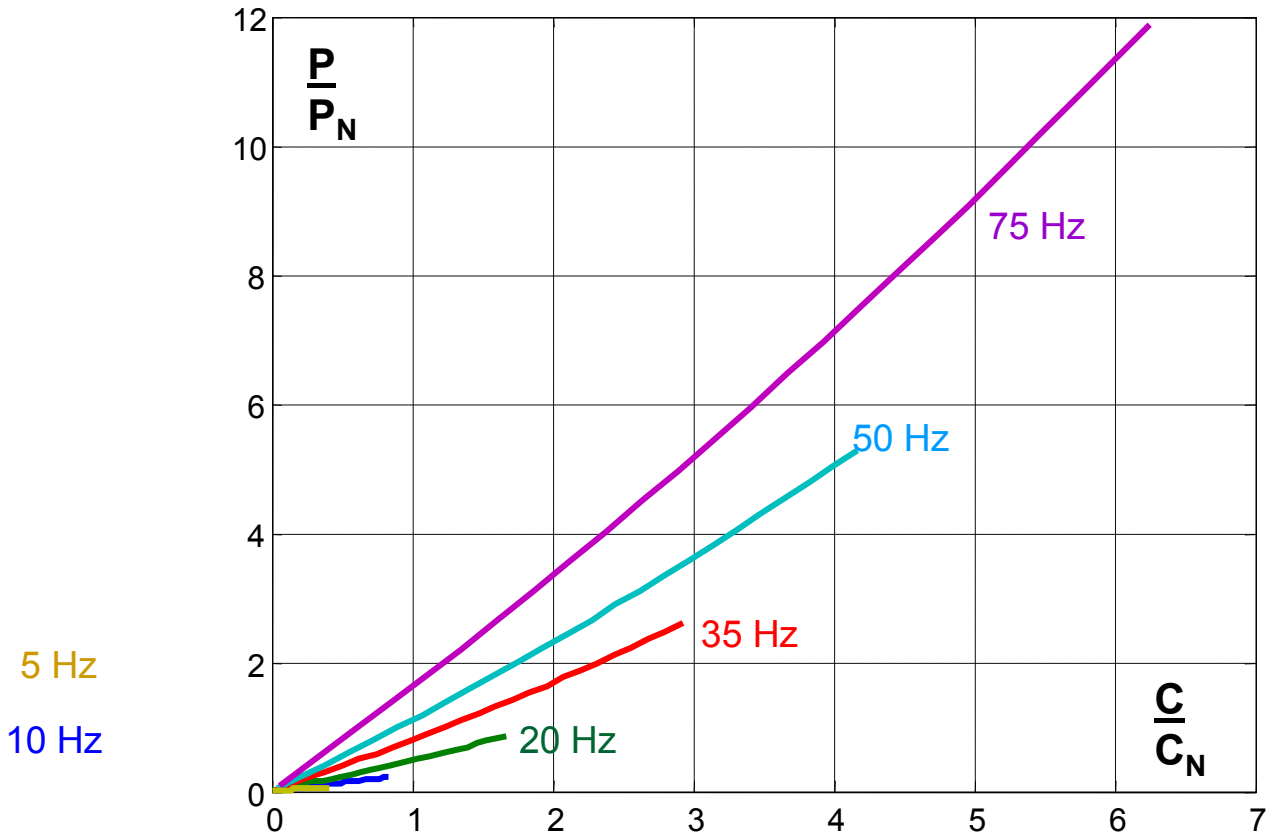
35 Hz

50 Hz

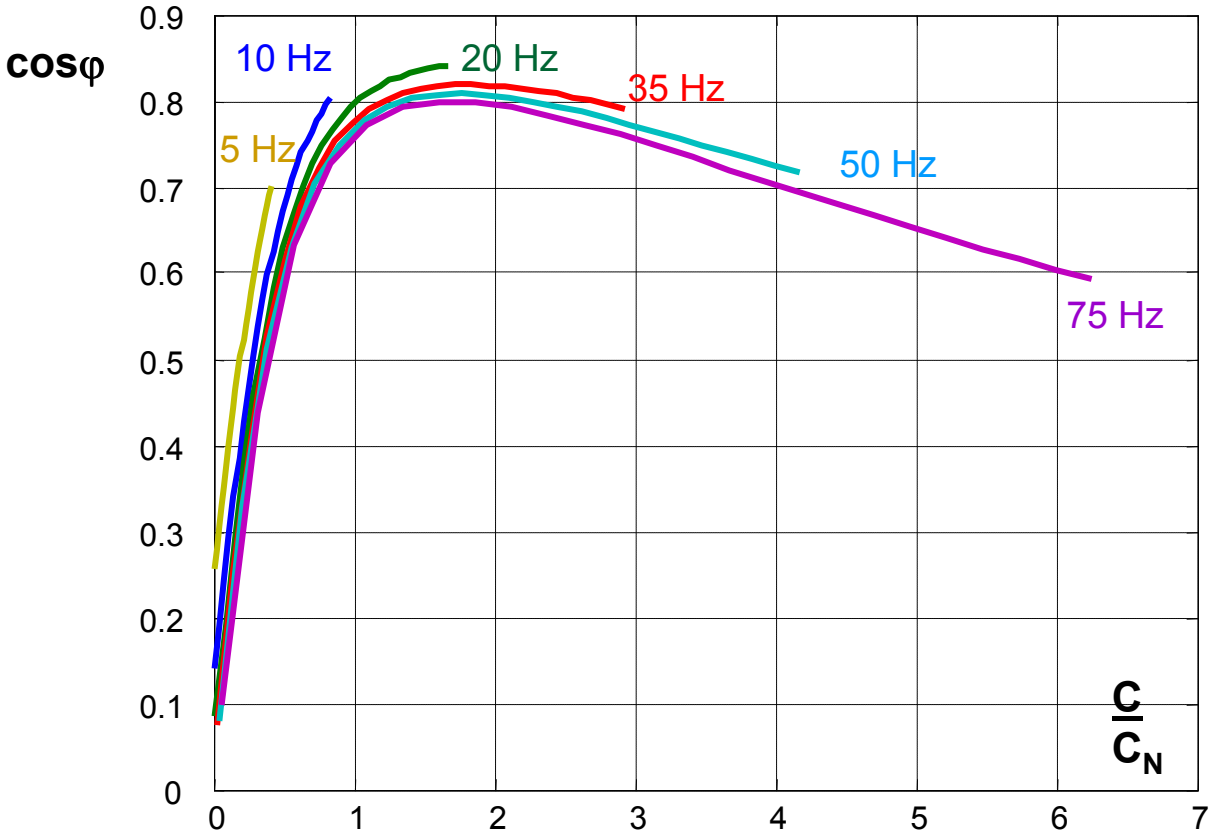
75 Hz



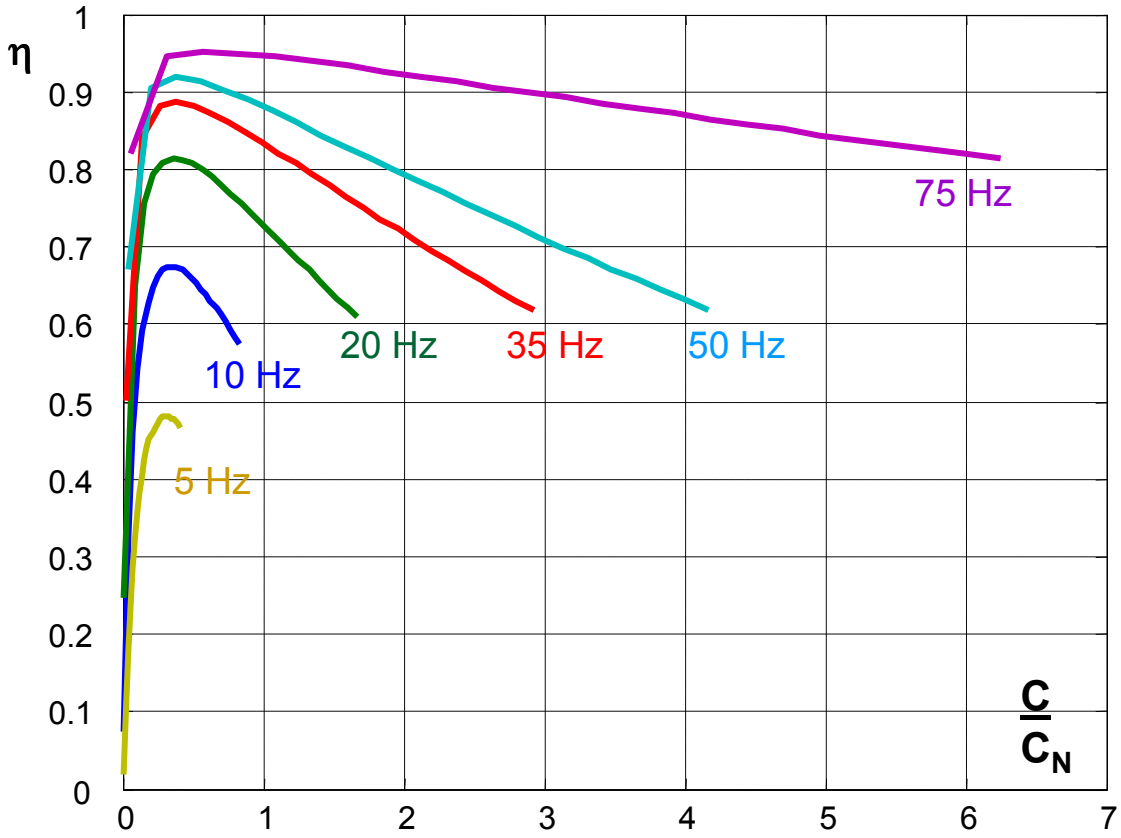
Comanda dupa fluxul rotoric



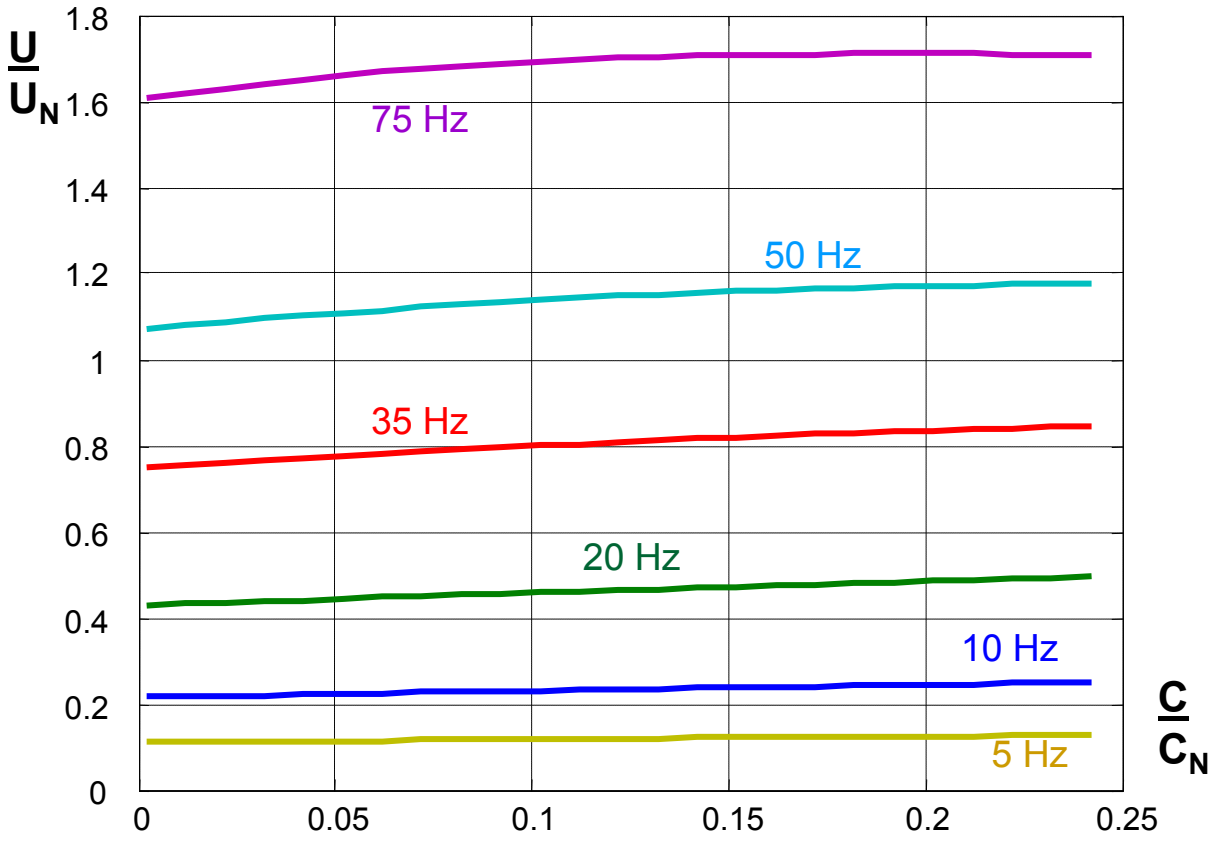
Comanda dupa fluxul rotoric



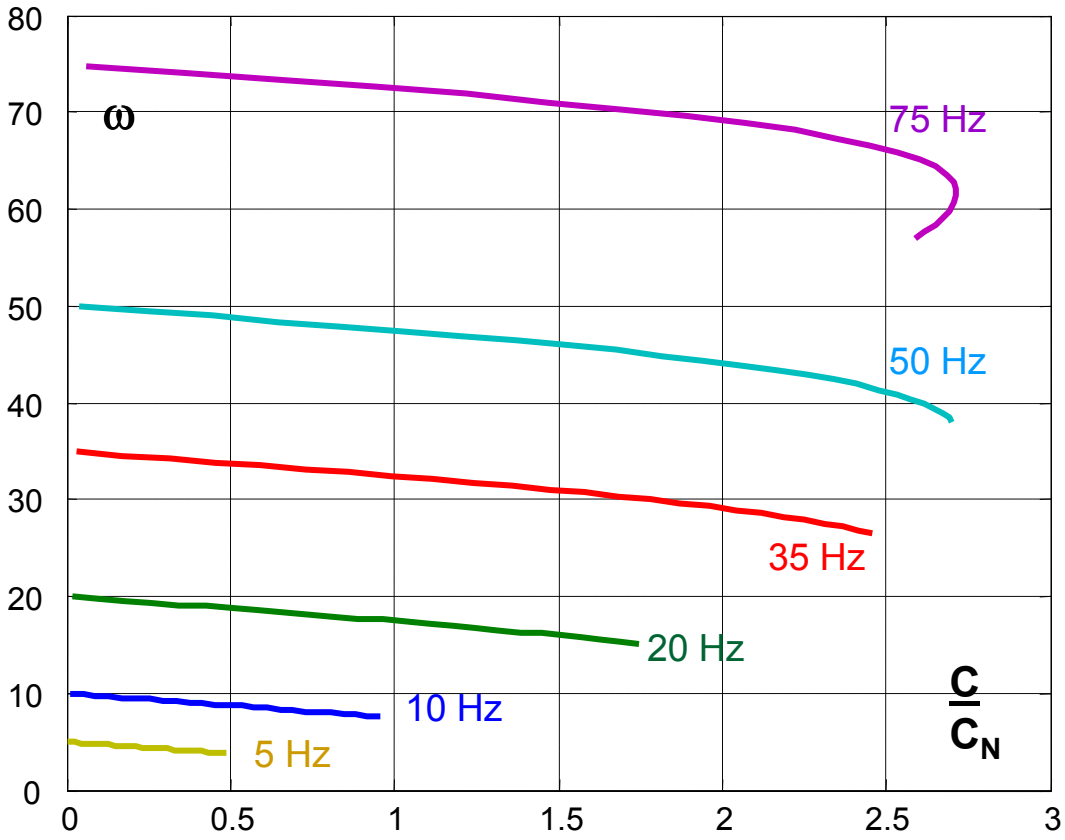
Comanda dupa fluxul rotoric



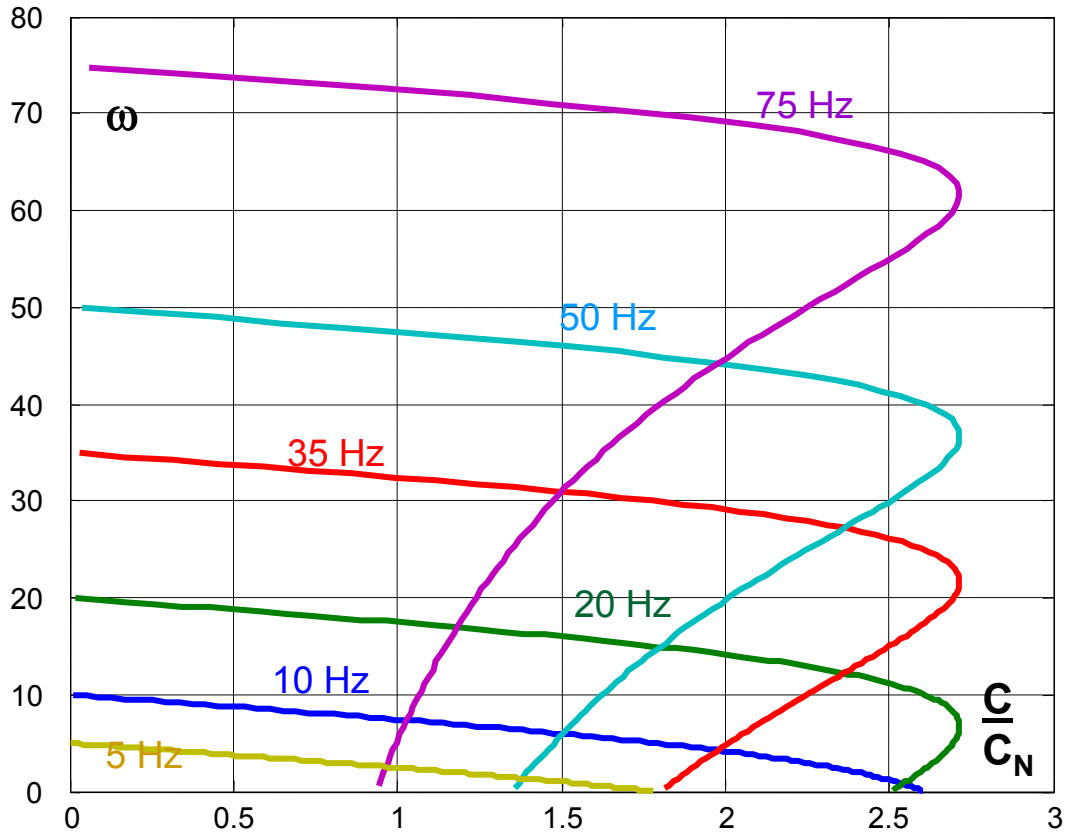
Comanda dupa fluxul statoric



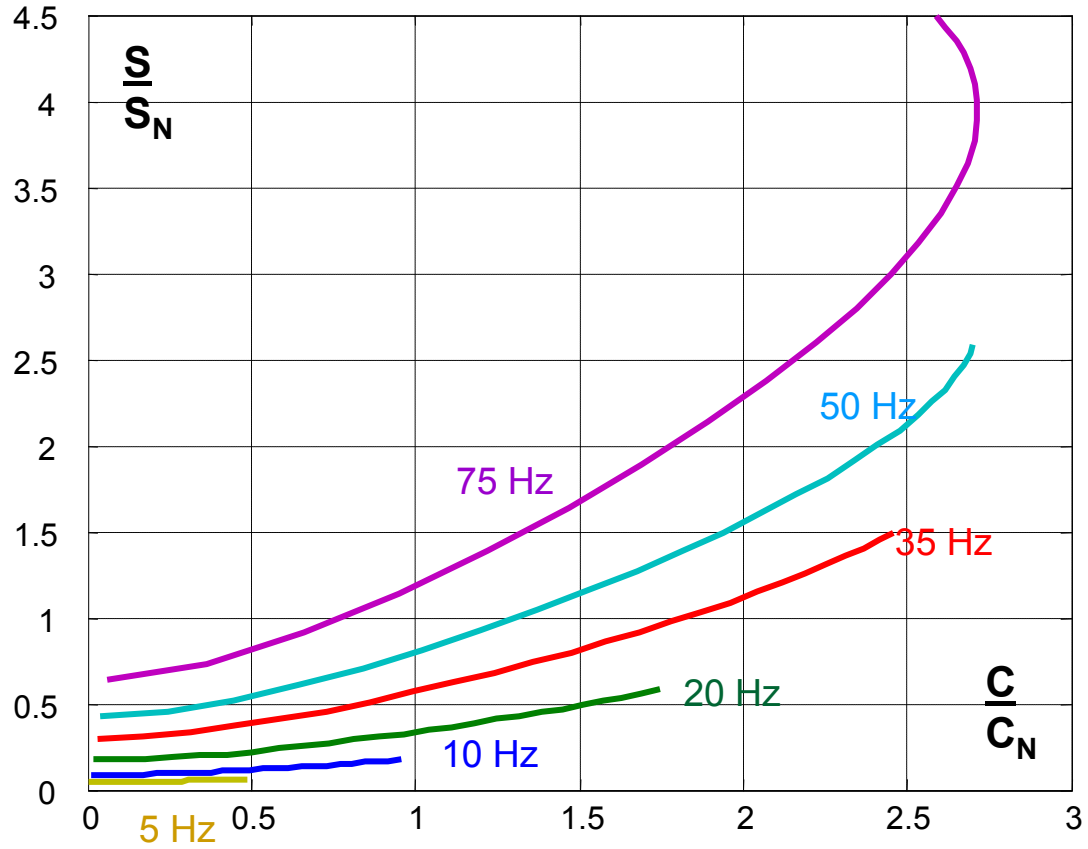
Comanda dupa fluxul statoric



Comanda dupa fluxul statoric



Comanda dupa fluxul statoric



Comanda dupa fluxul statoric

5 Hz

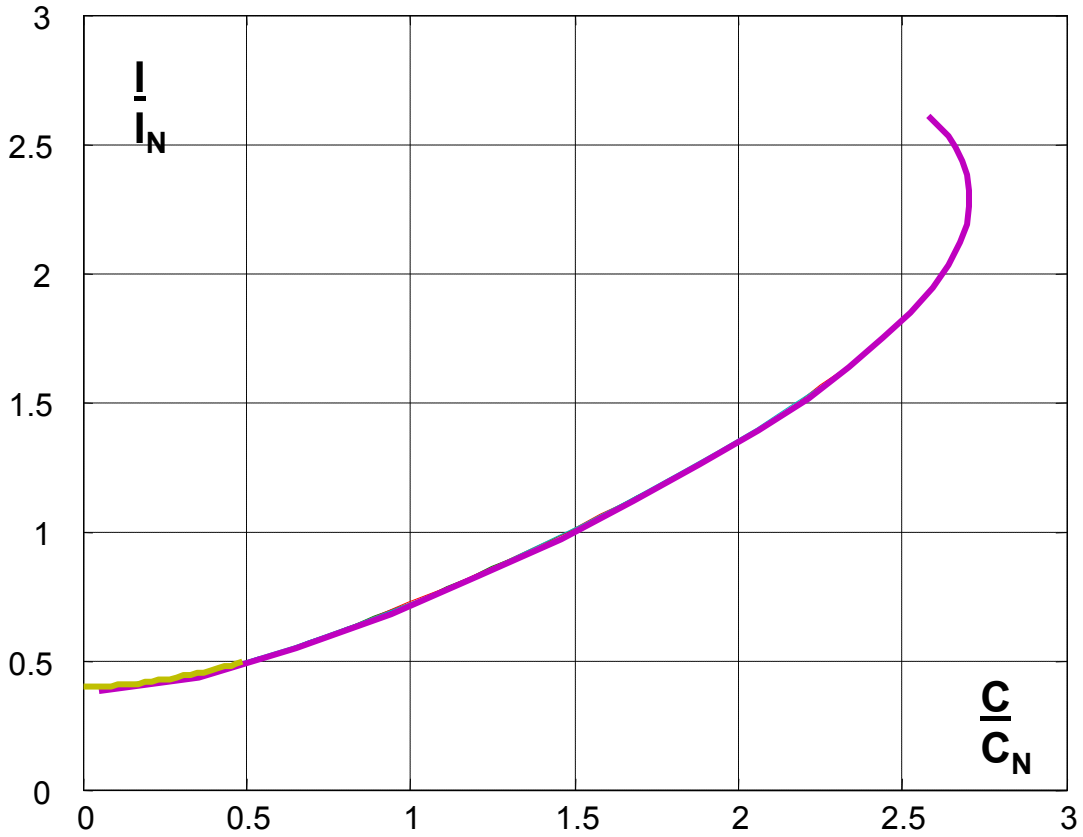
10 Hz

20 Hz

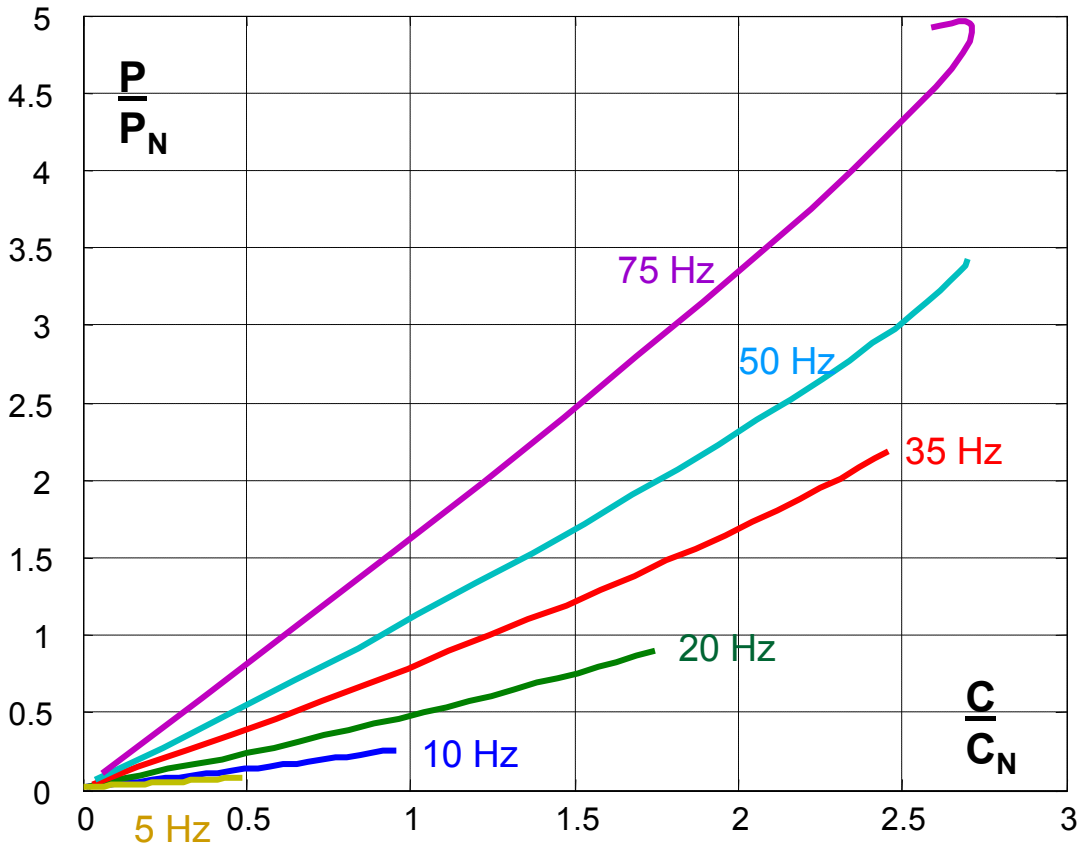
35 Hz

50 Hz

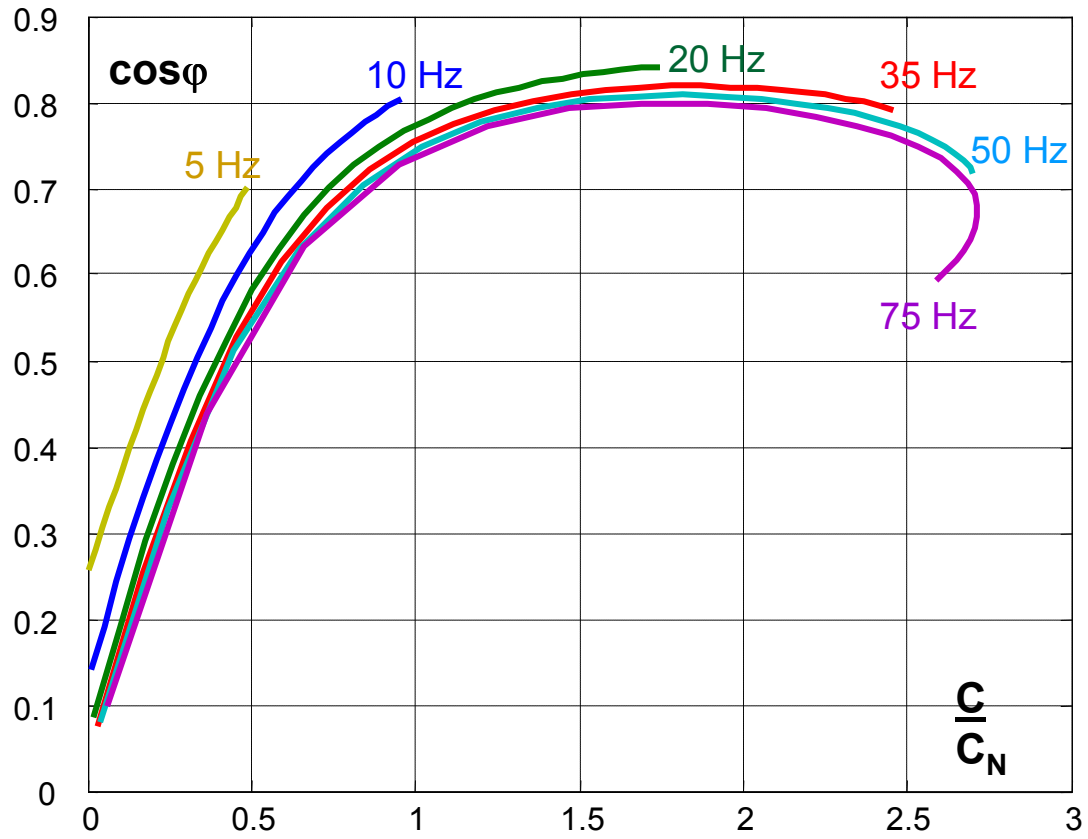
75 Hz



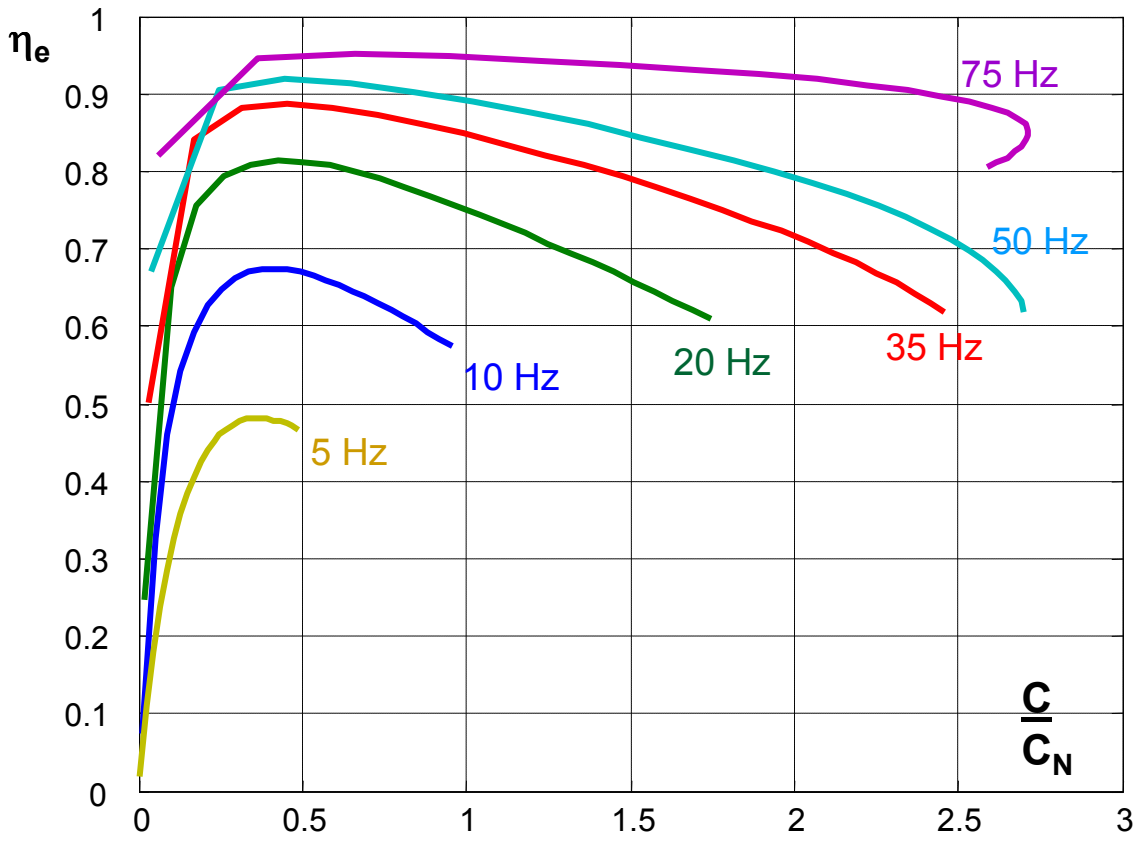
Comanda dupa fluxul statoric



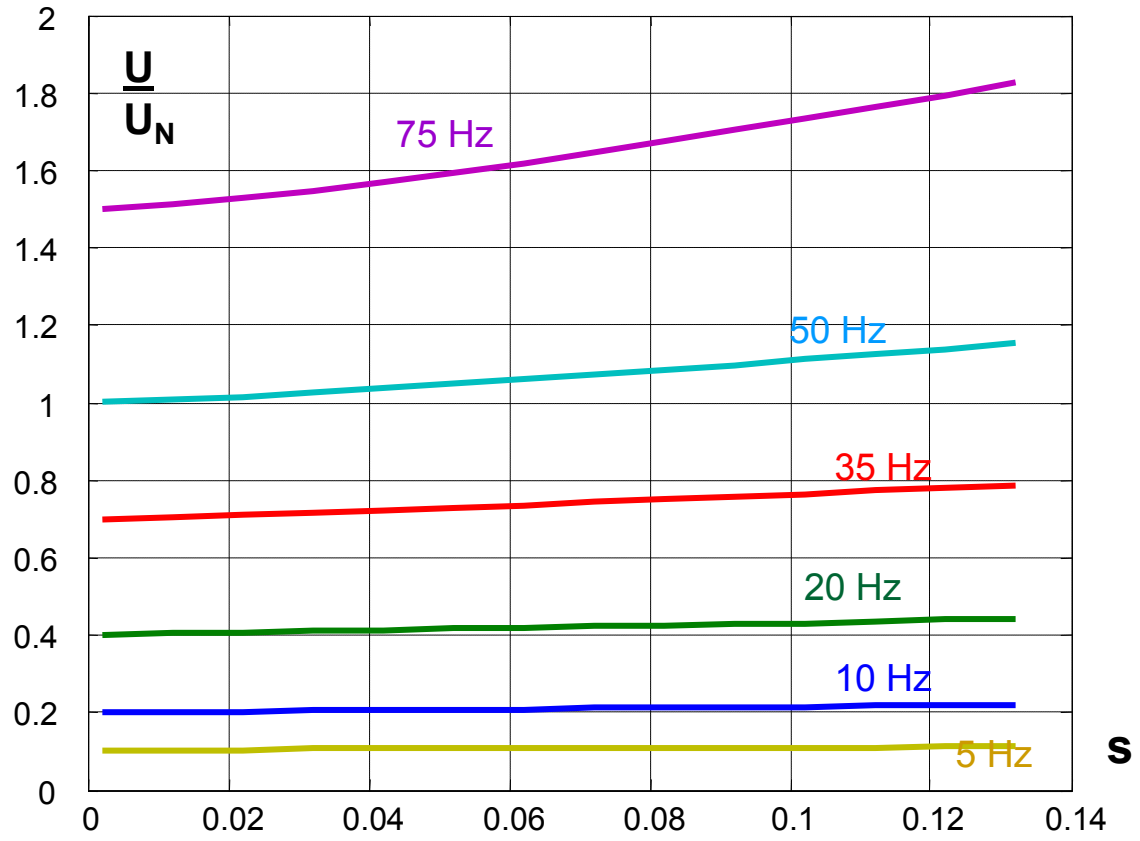
Comanda dupa fluxul statoric



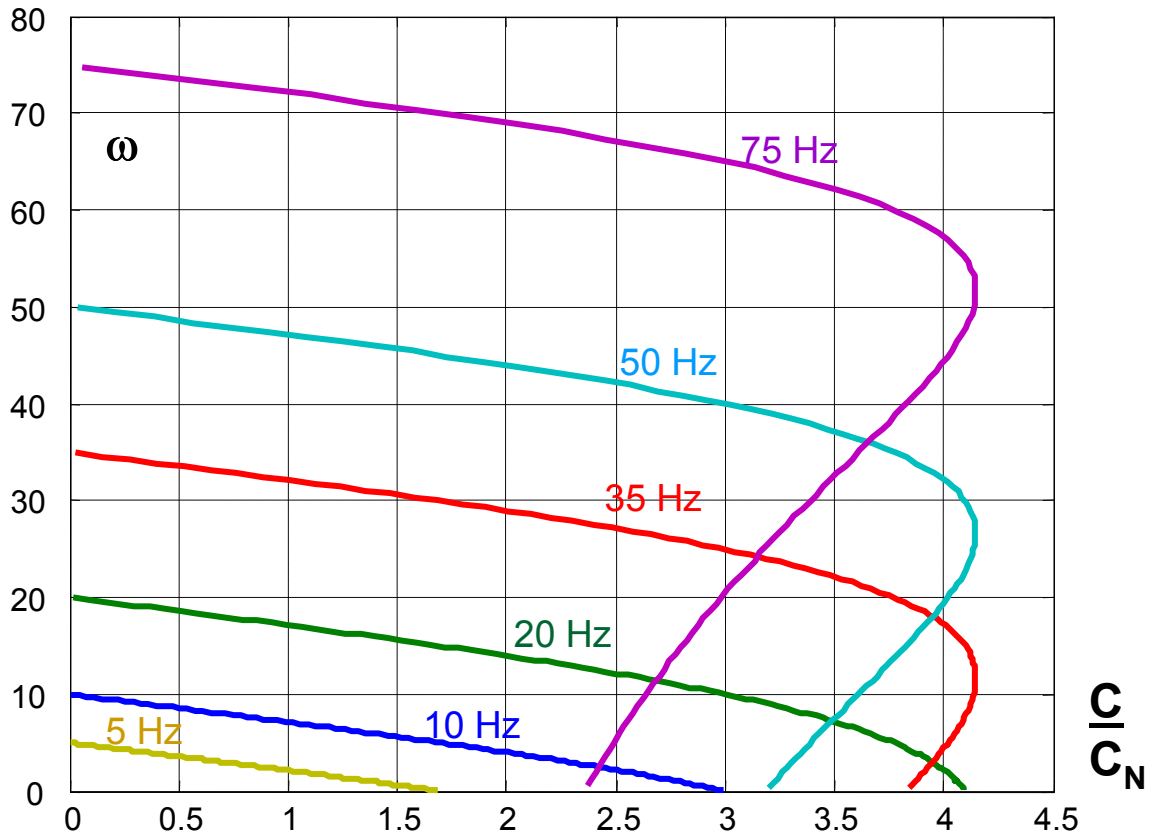
Comanda dupa fluxul statoric



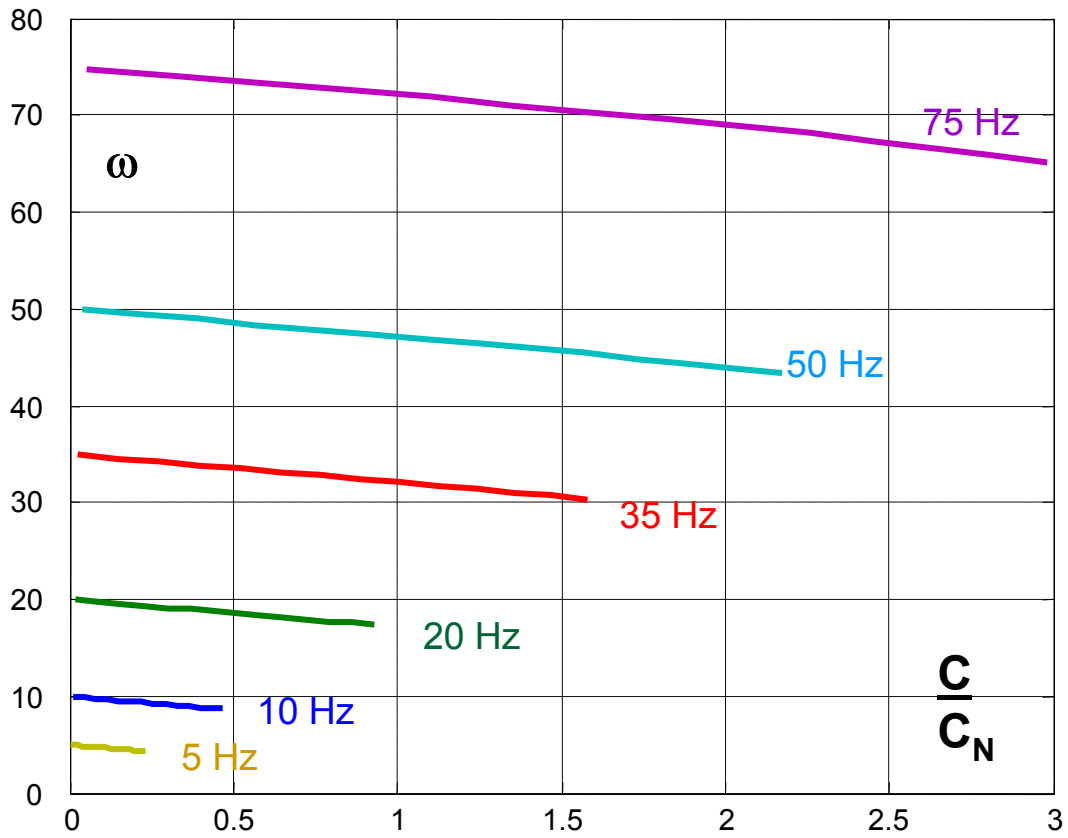
Comanda dupa fluxul de magnetizare



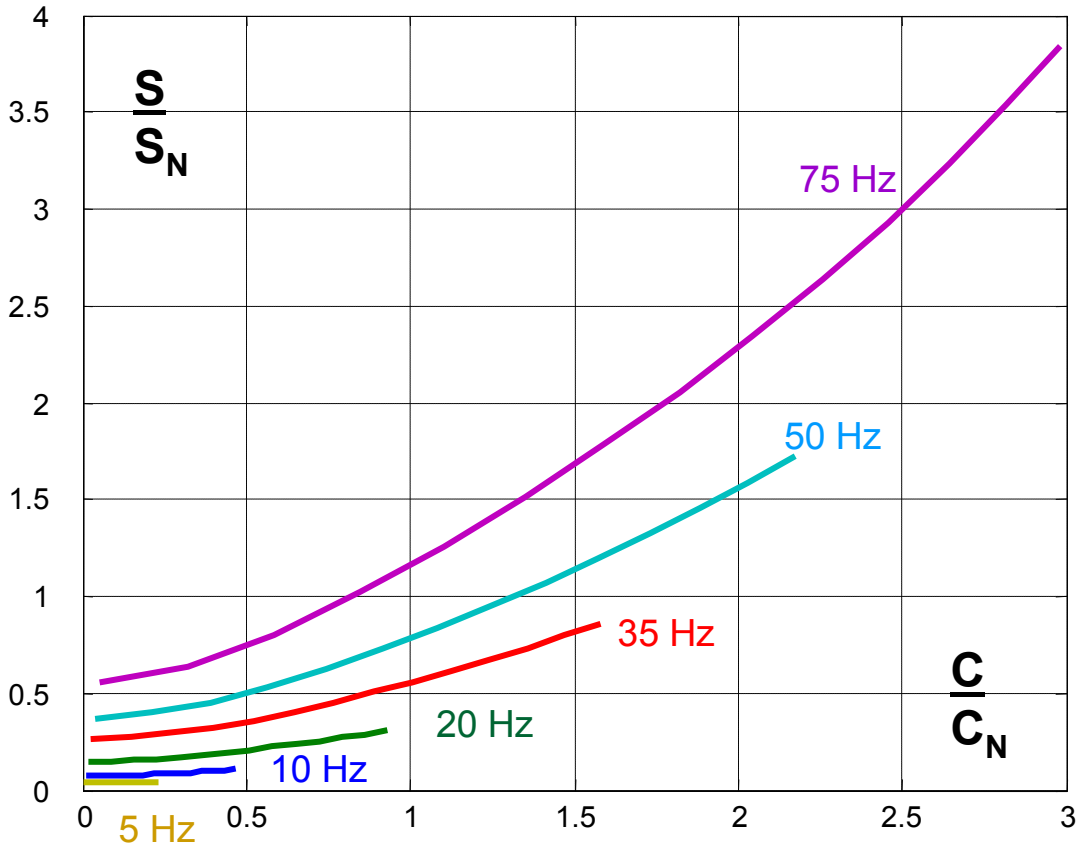
Comanda dupa fluxul de magnetizare



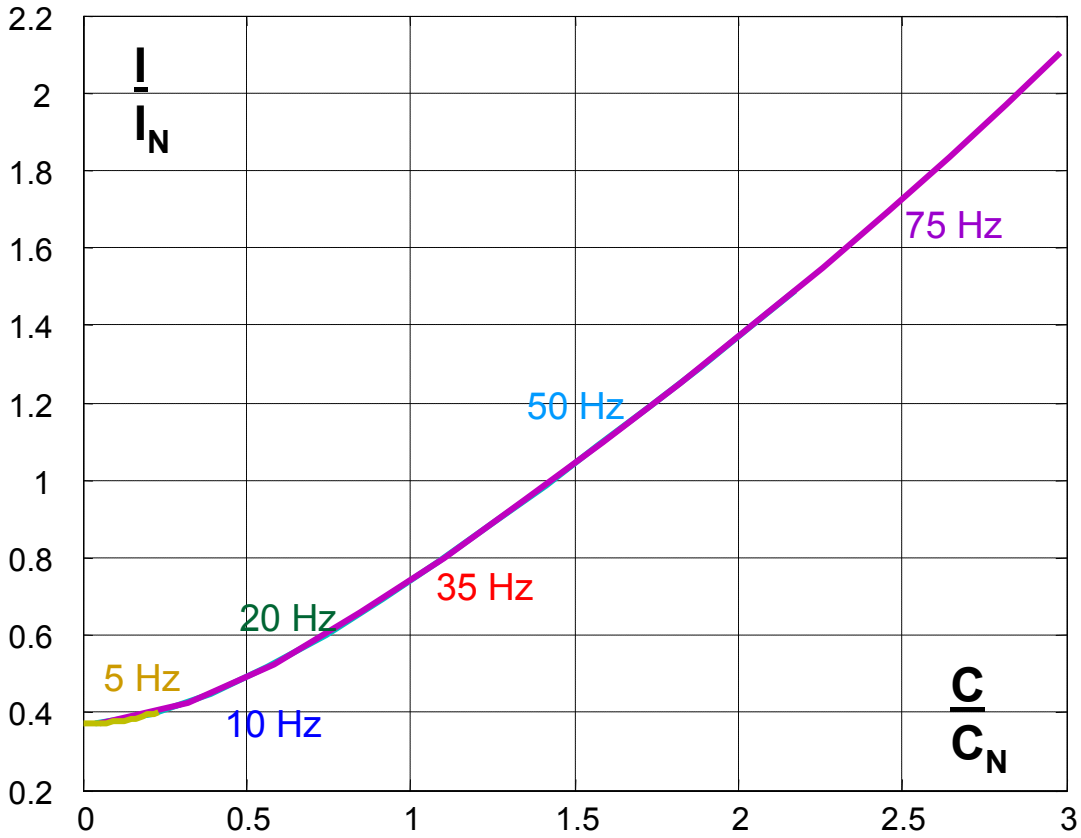
Comanda dupa fluxul de magnetizare



Comanda dupa fluxul de magnetizare



Comanda dupa fluxul de magnetizare



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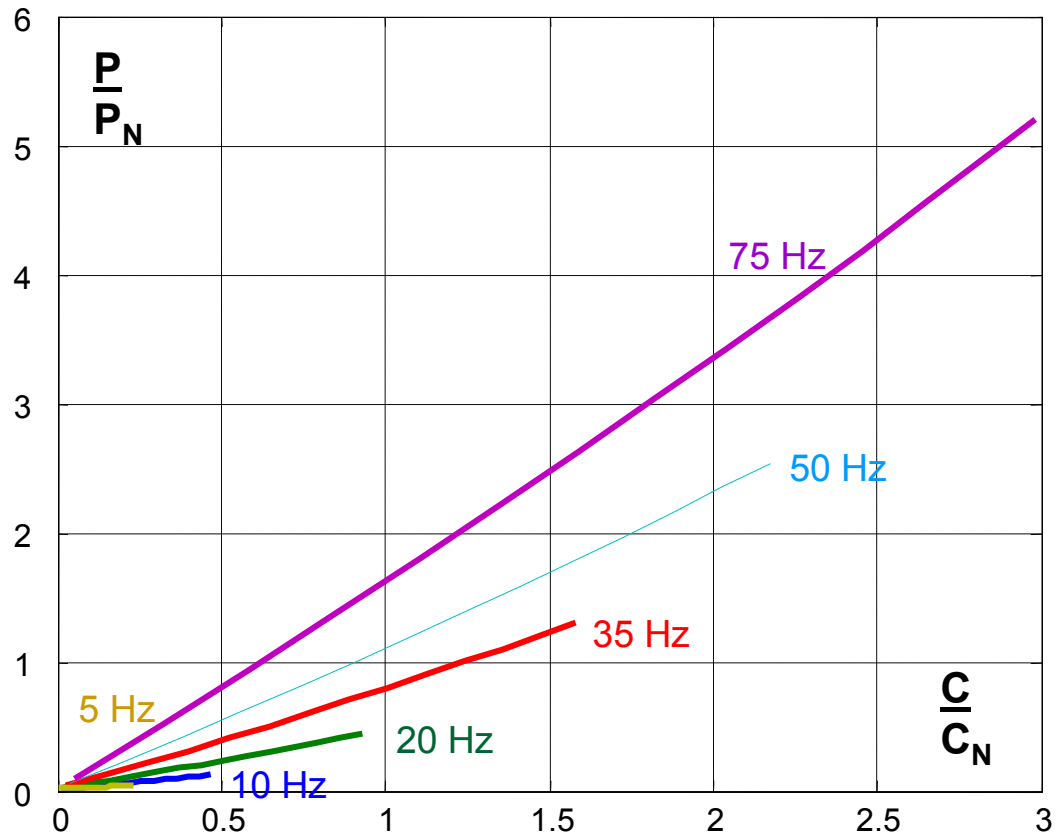

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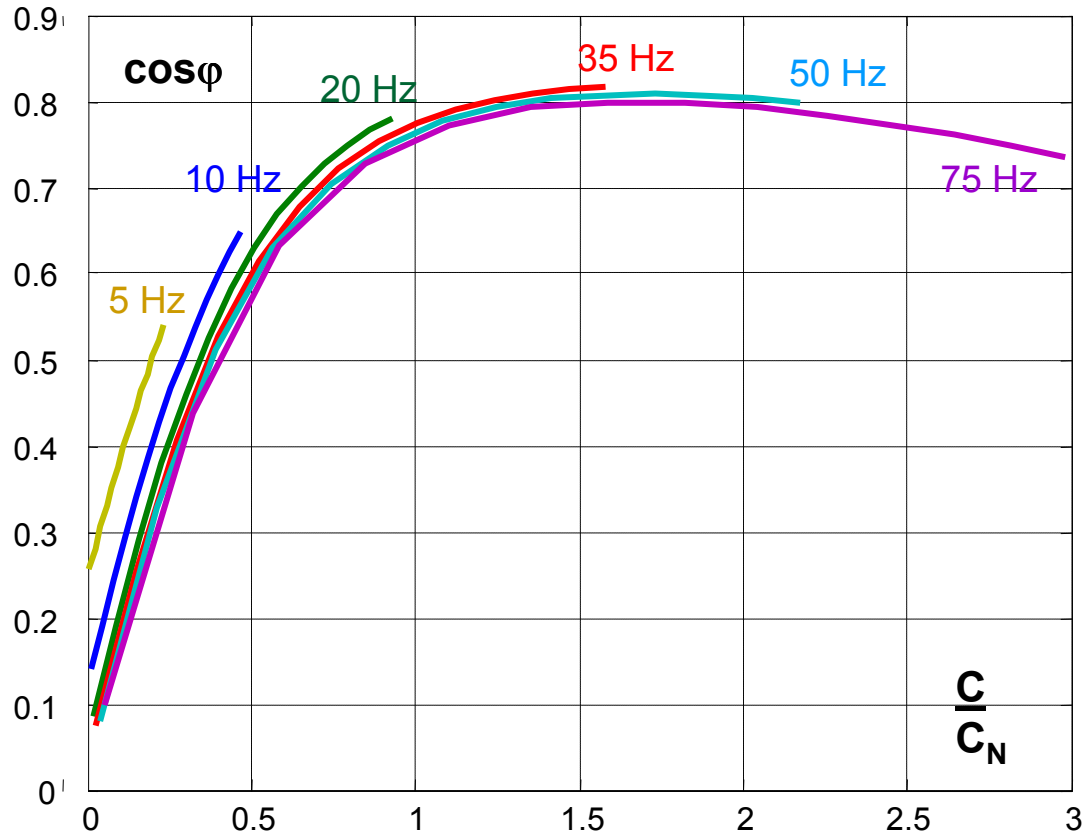

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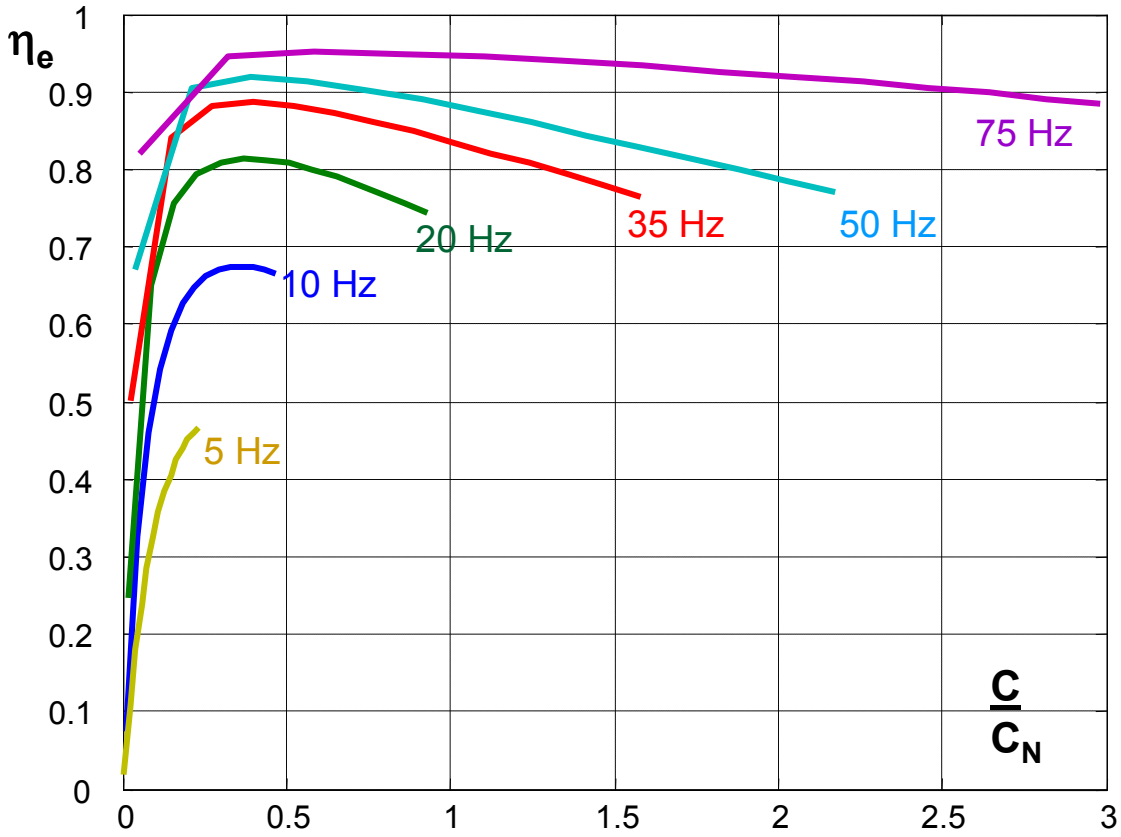
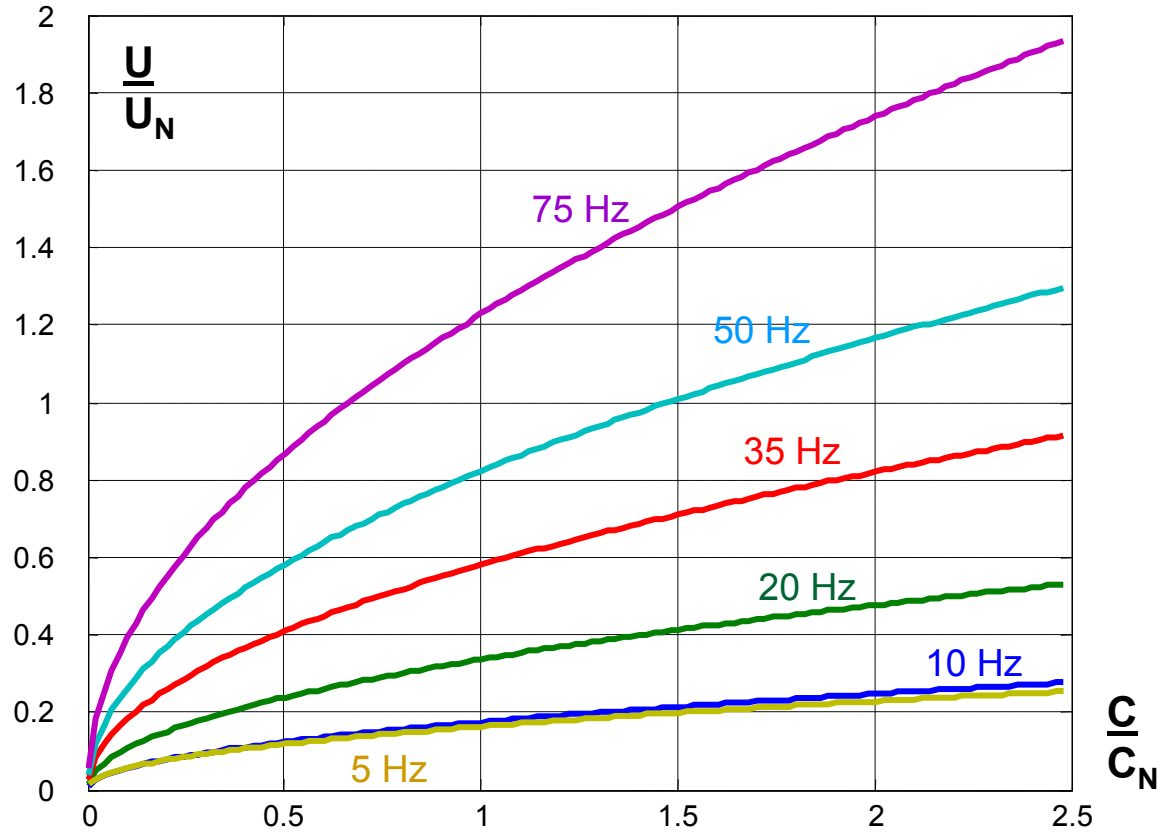


Comanda dupa frecventa rotorica constanta



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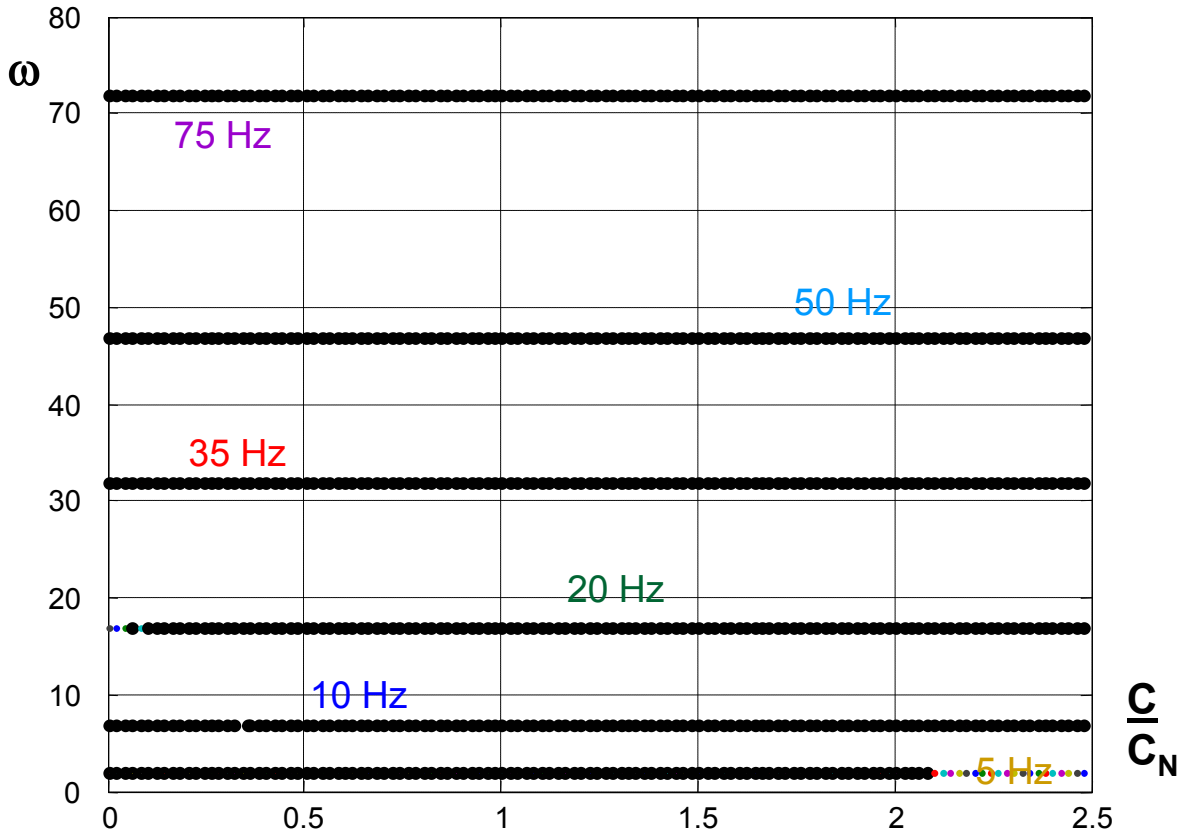

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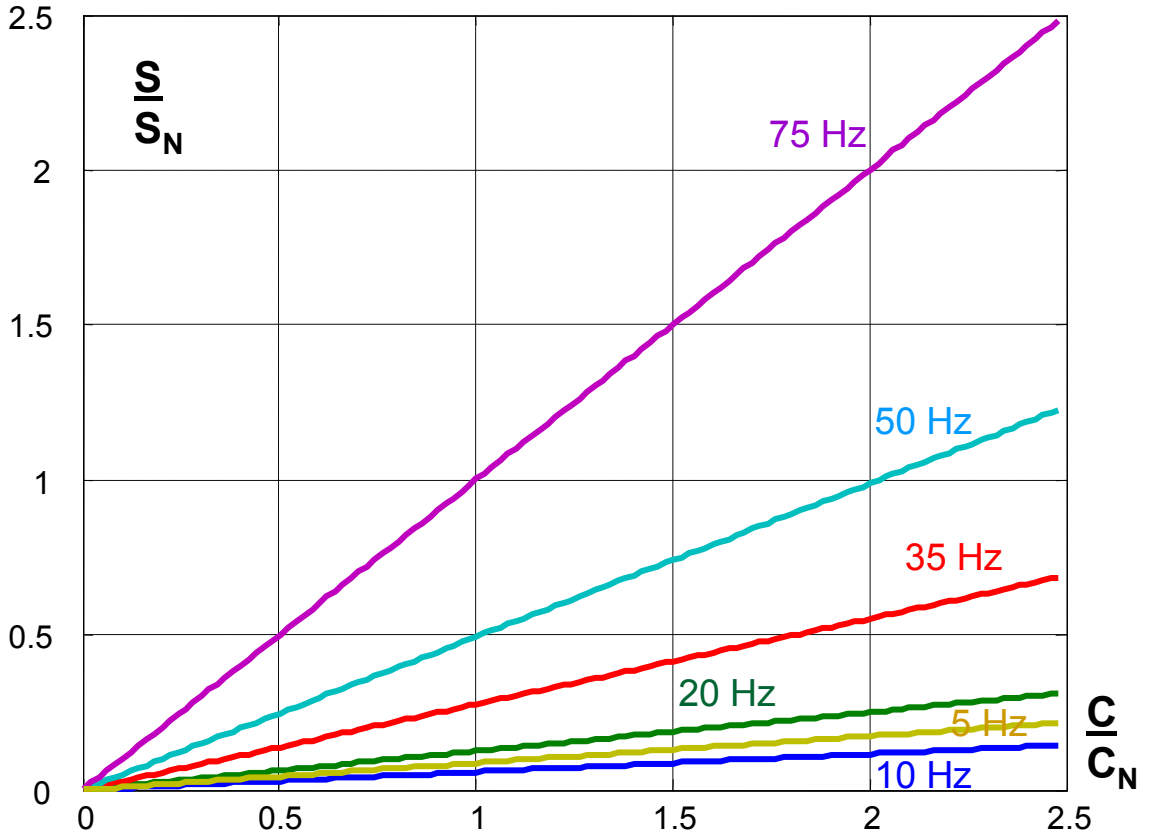

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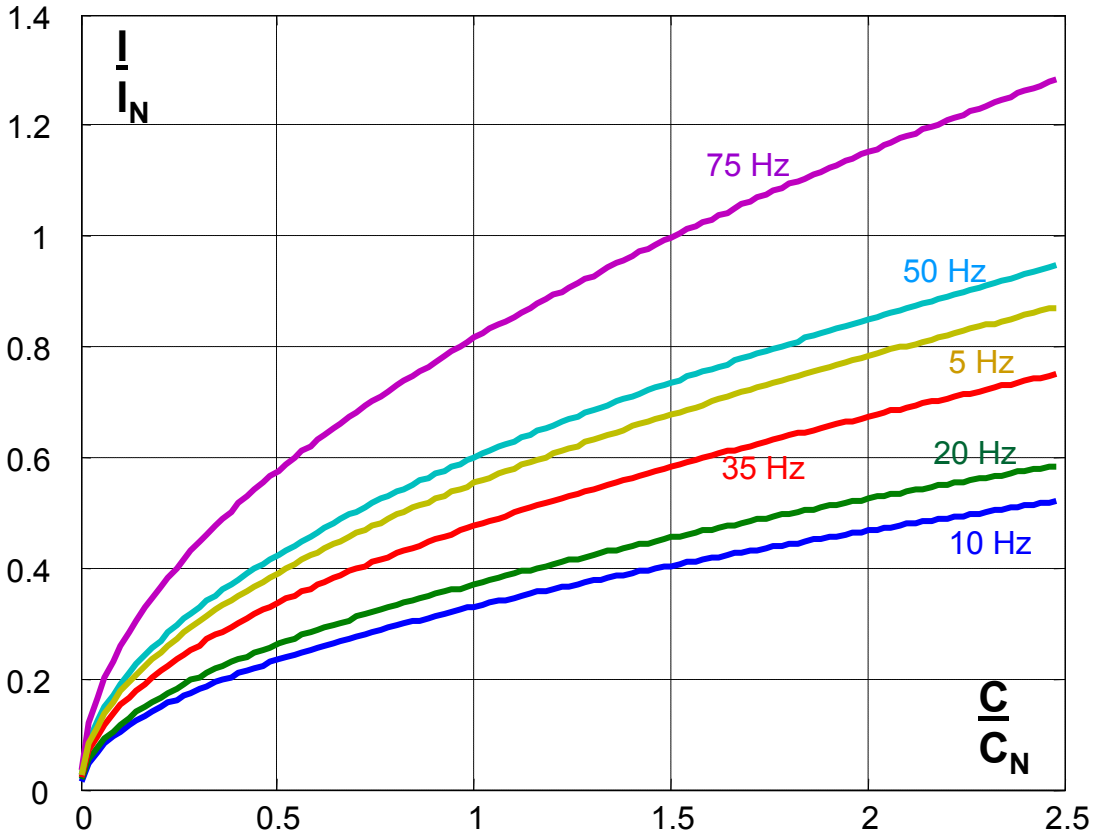
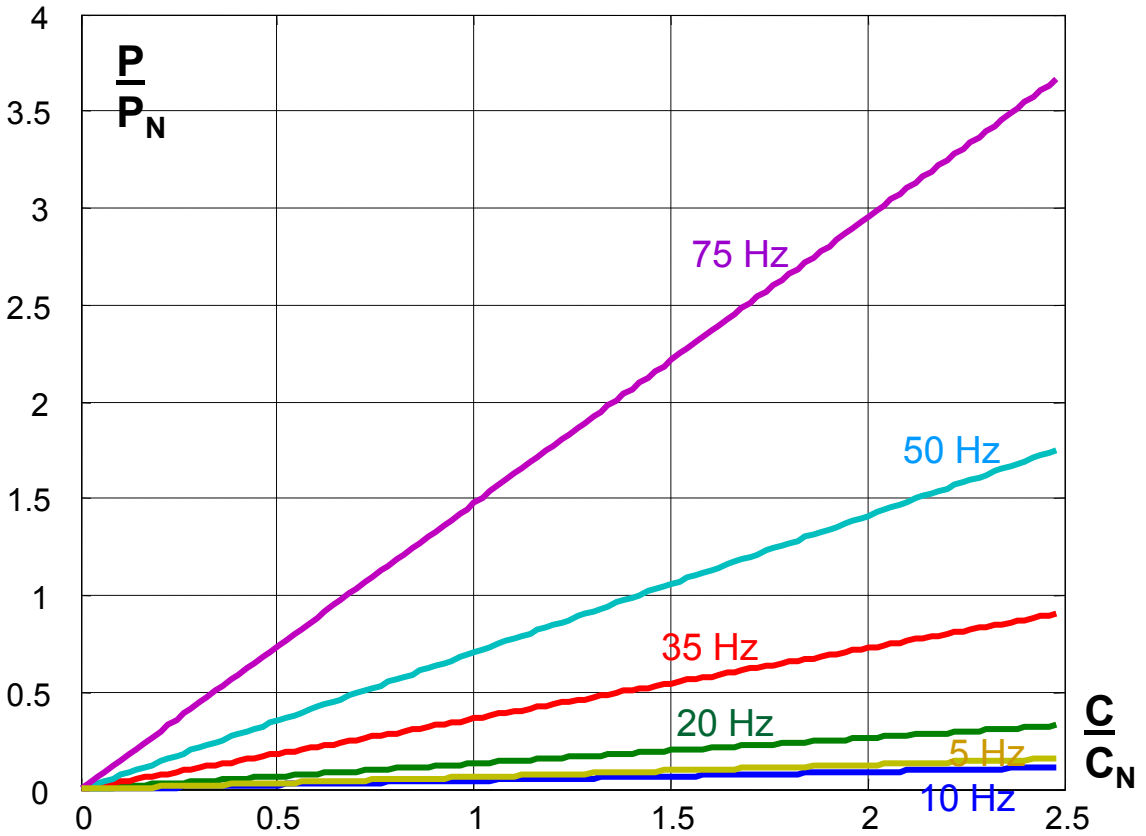


Comanda dupa frecventa rotorica constanta



Comanda dupa frecventa rotorica constanta

5 Hz

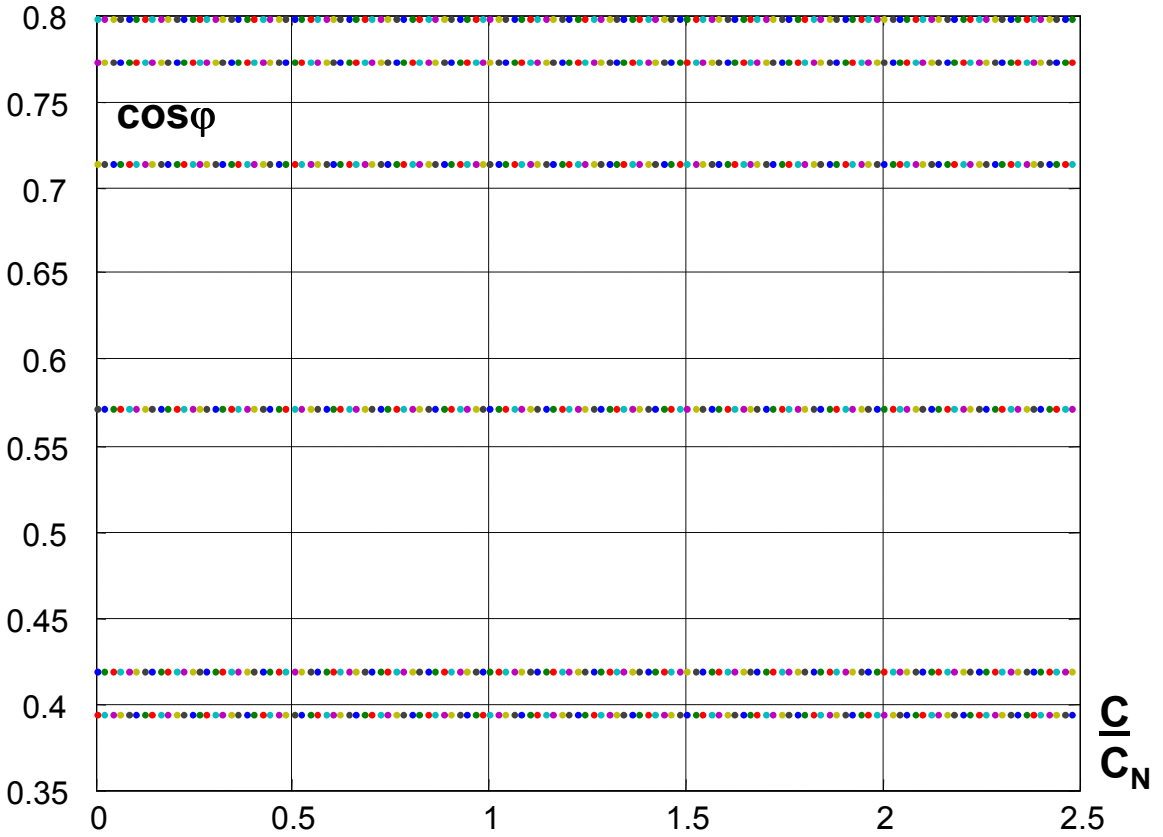
10 Hz

20 Hz

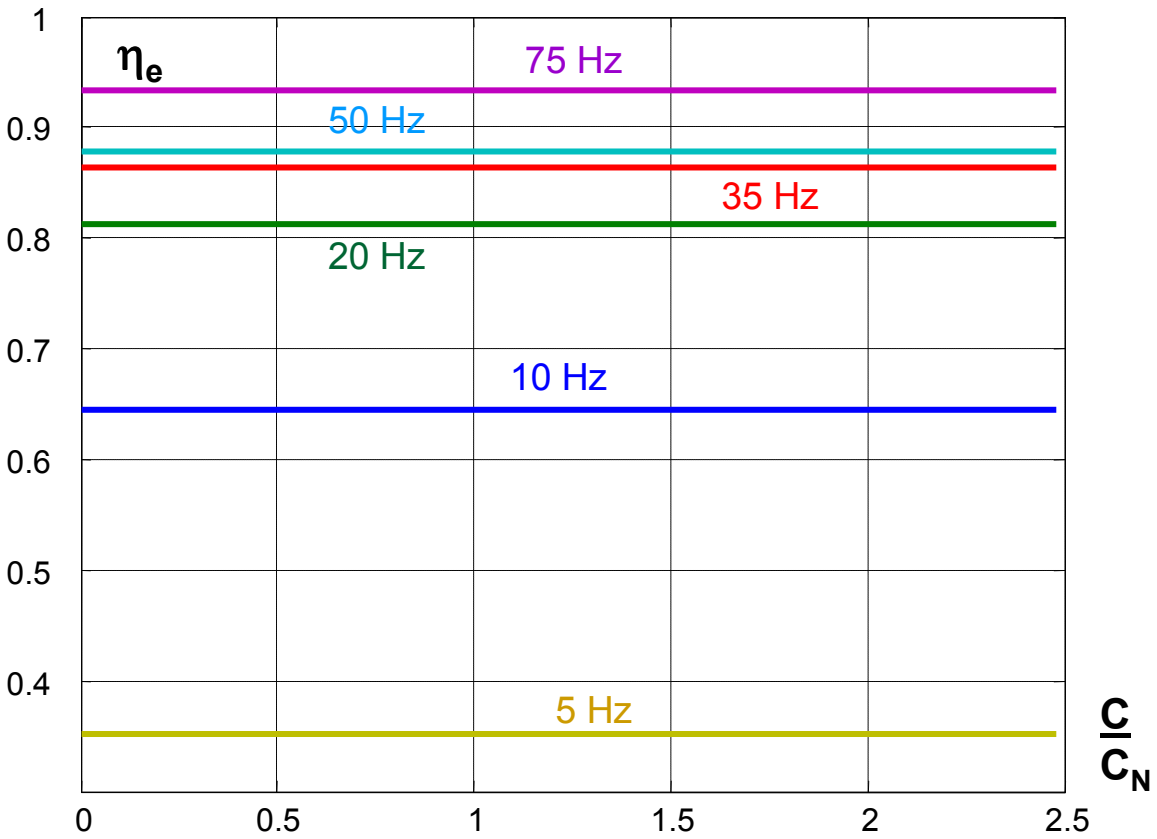
35 Hz

50 Hz

75 Hz

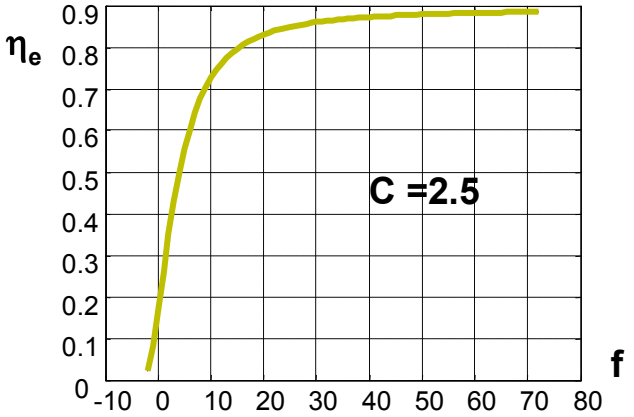


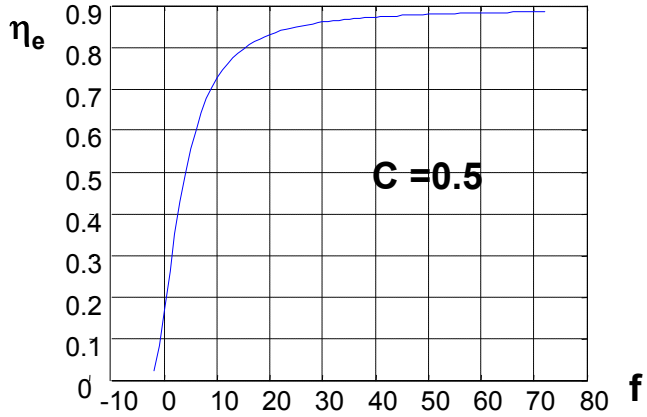
Comanda dupa frecventa rotorica constanta

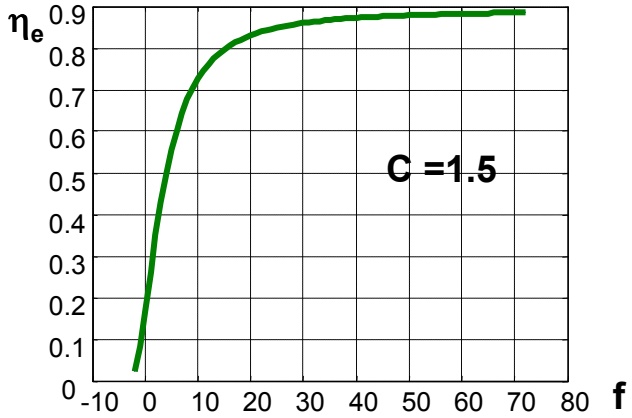


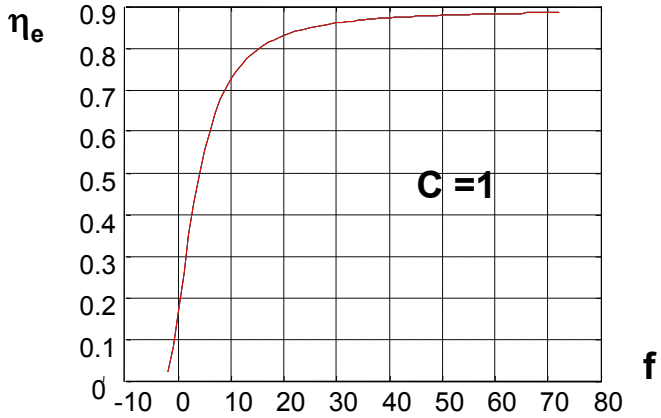
Comanda dupa frecventa rotorica constanta

Variatia randamentului cu frecventa la 4 valori ale cuplului

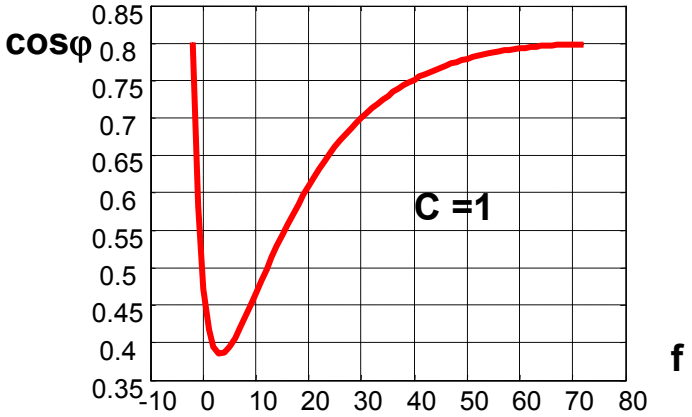


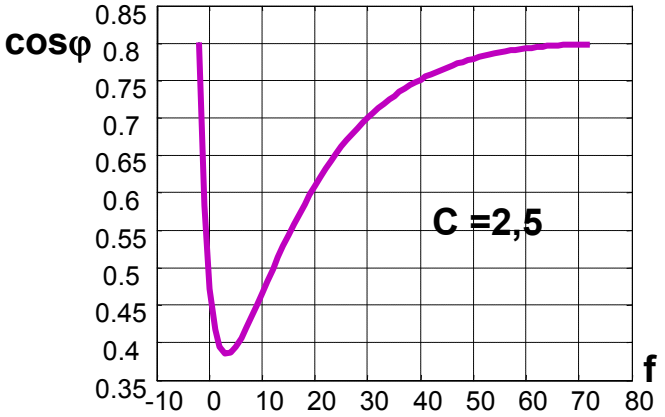


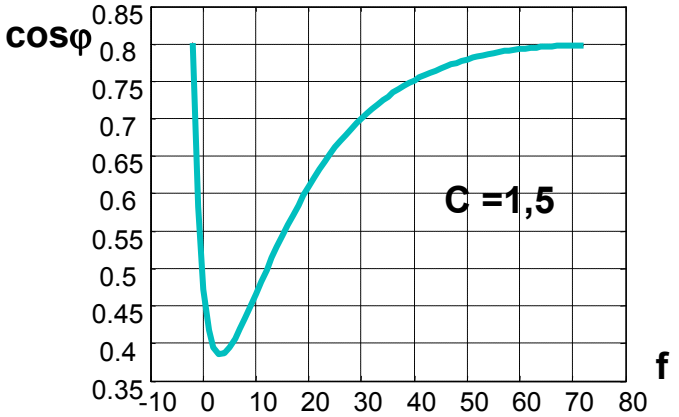


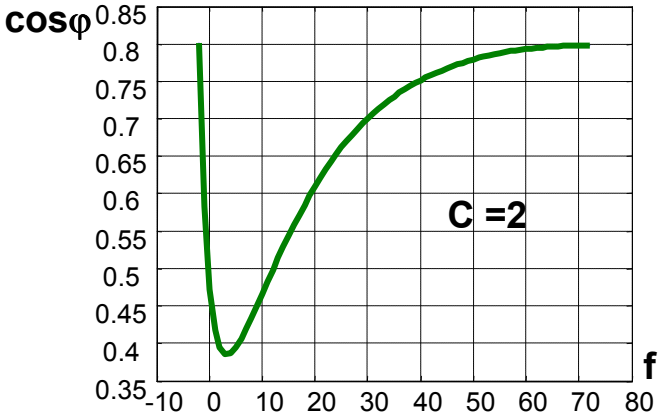


Comanda dupa frecventa rotorica constanta

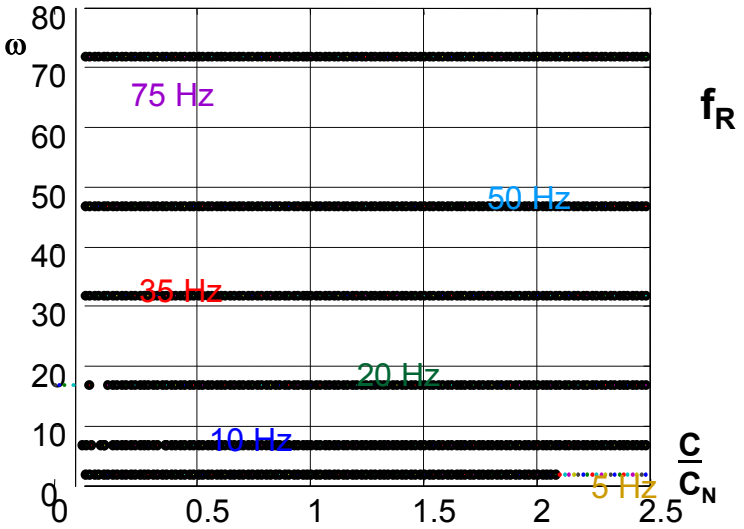




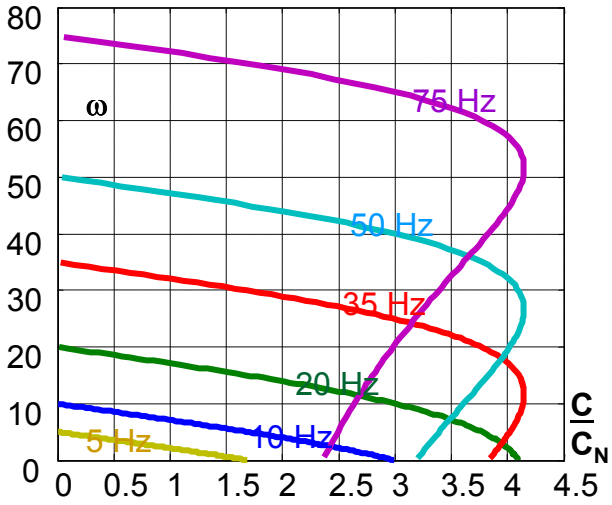




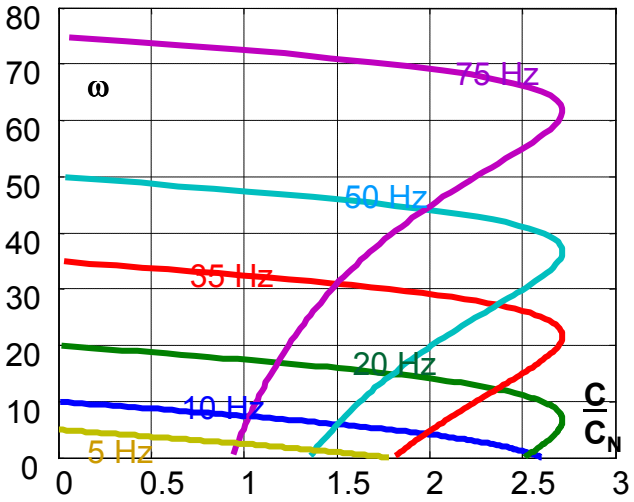
Caracteristicile mecanice comparate



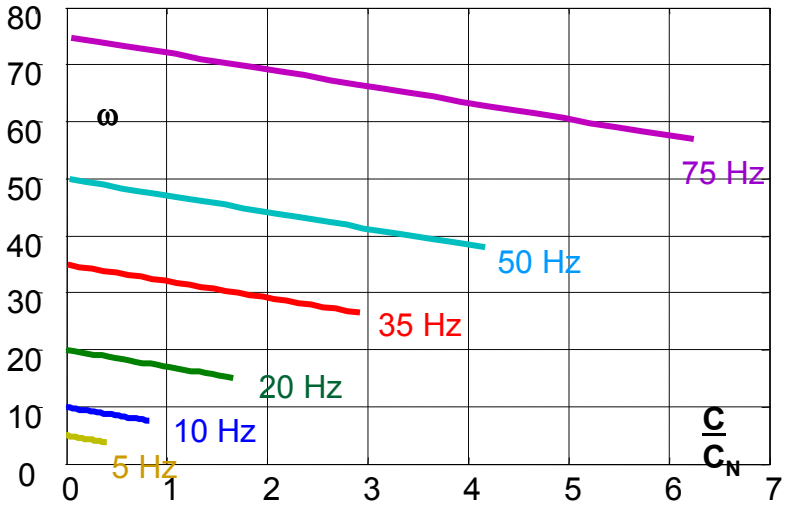
f_R



ψ_m

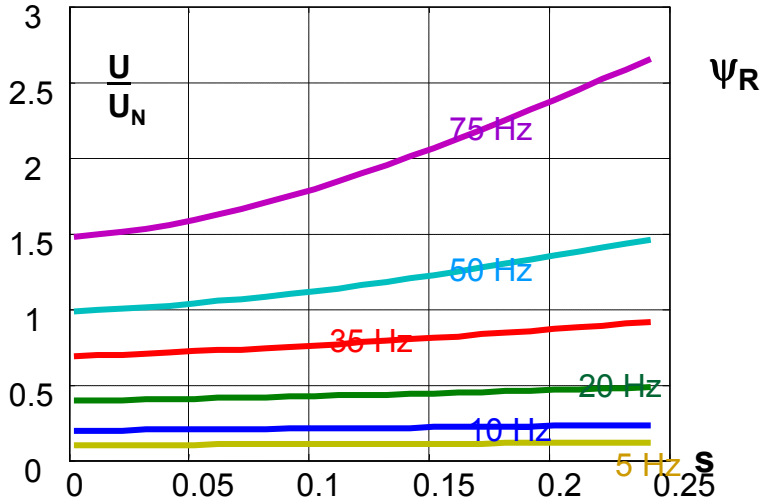


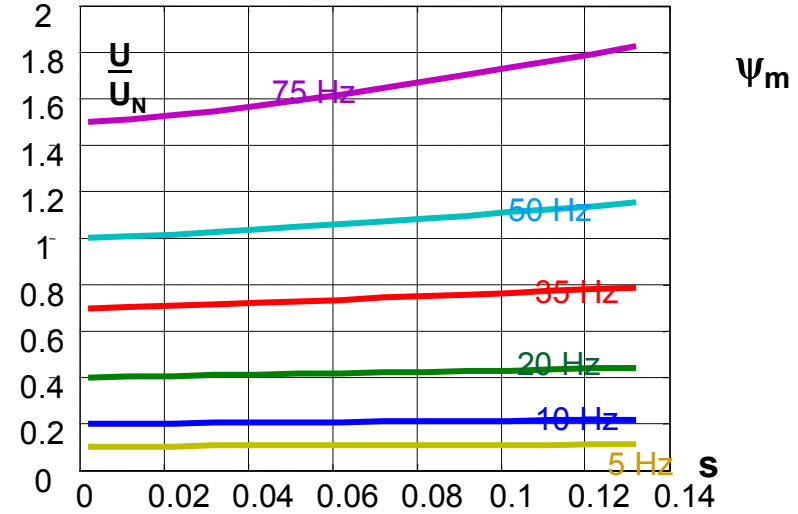
ψ_S

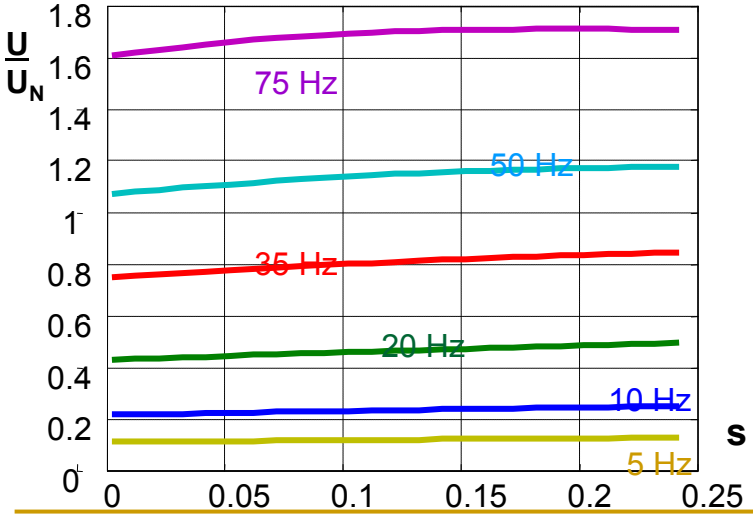


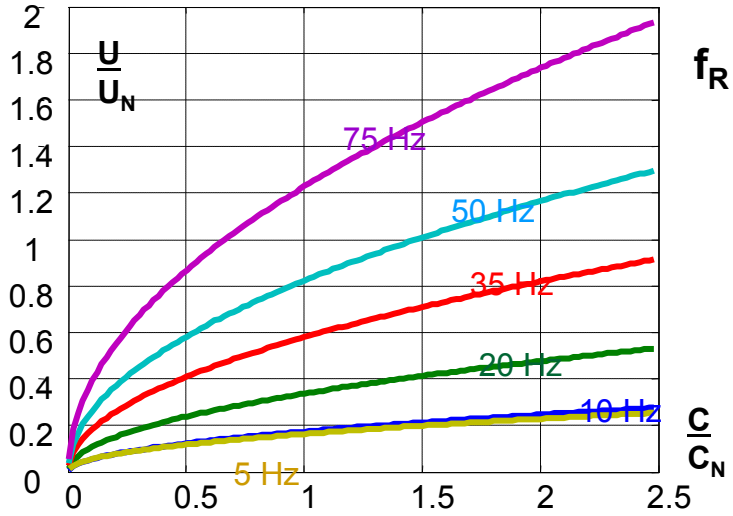
ψ_R

Variatia tensiunii la bornenele motorului

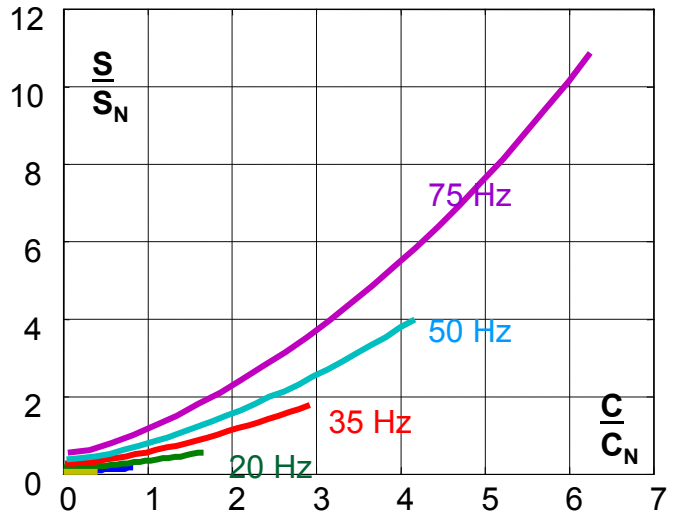


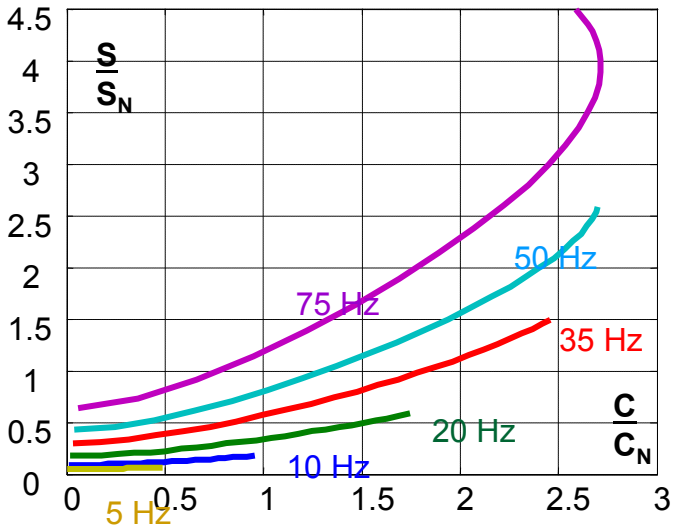


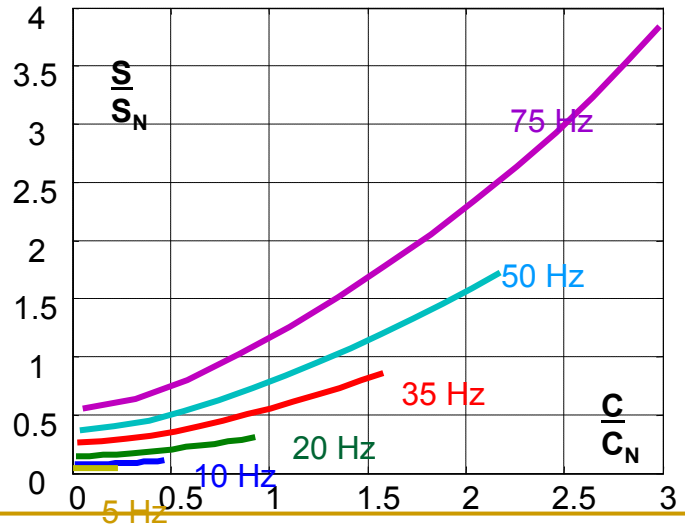


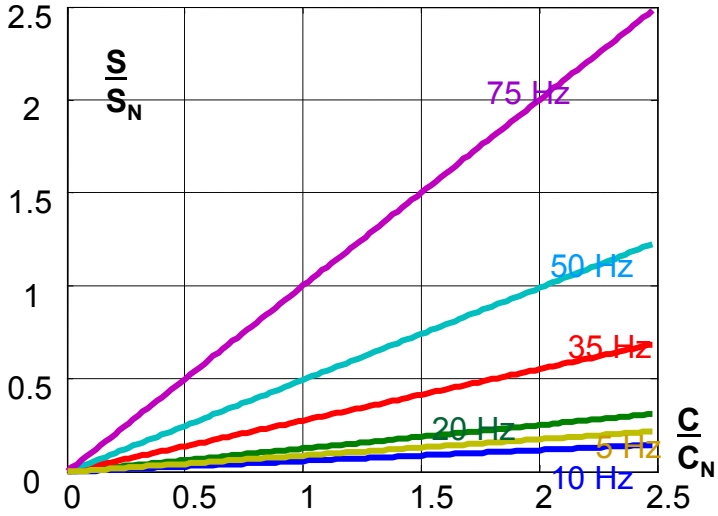


Puterea aparenta necesara

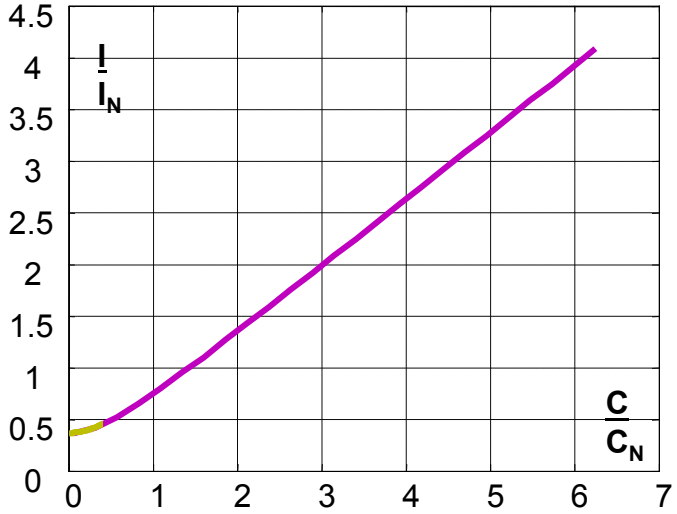




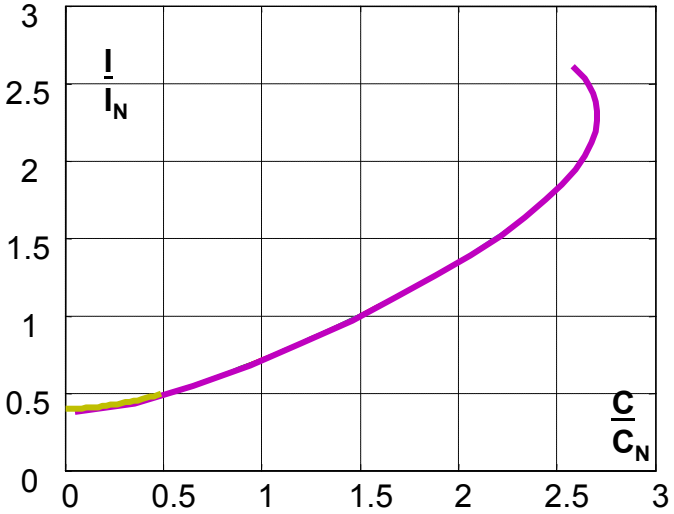




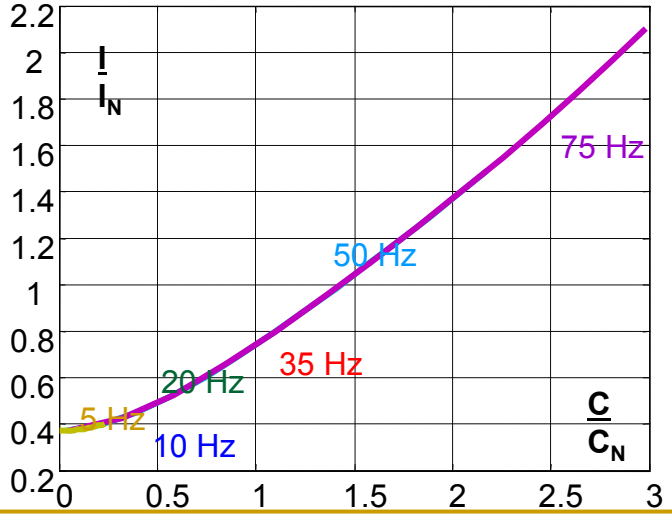
Curentul statoric absorbit



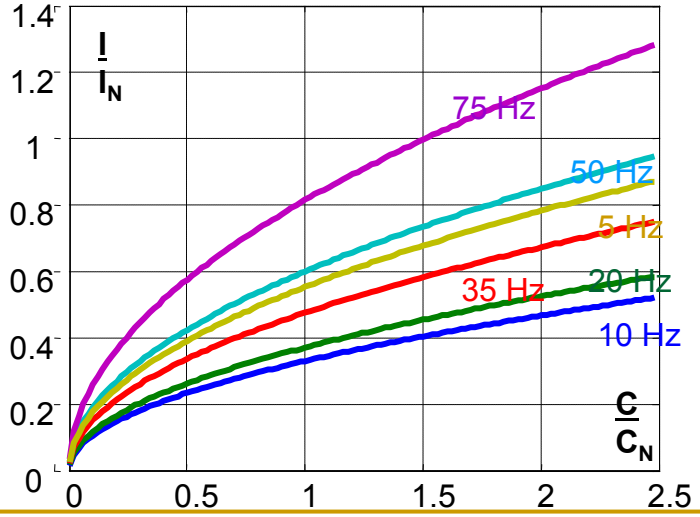
ψ_R



ψ_S

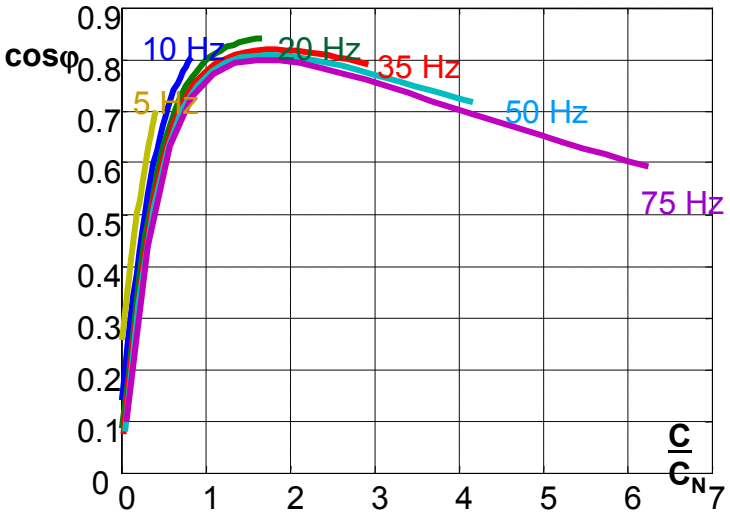


ψ_m

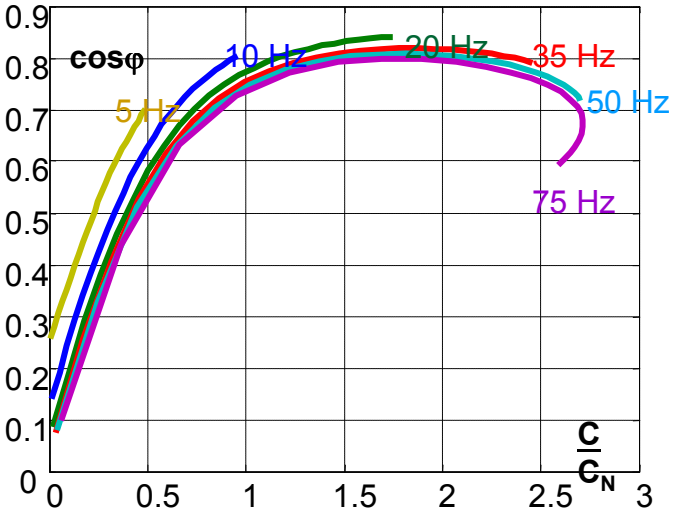


f_R

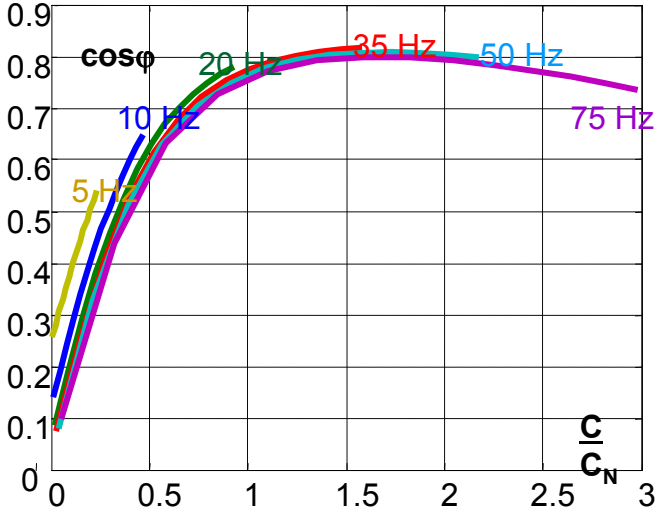
Factorul de putere



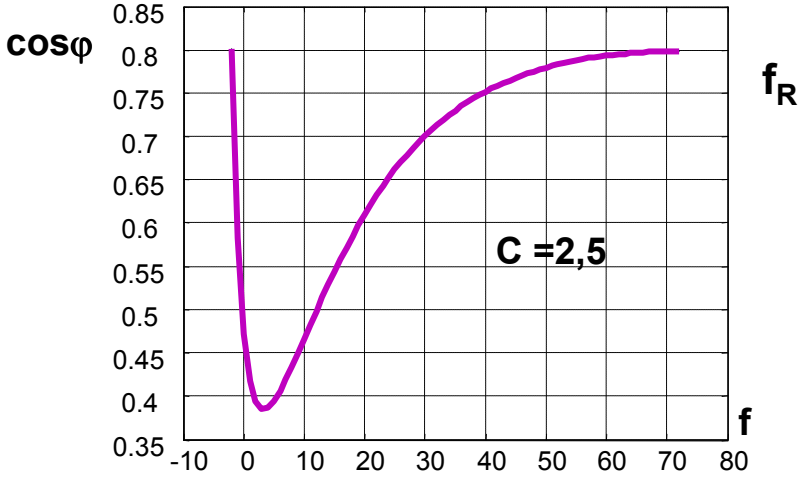
ψ_R



ψ_S



ψ_m



f_R

Randamentul