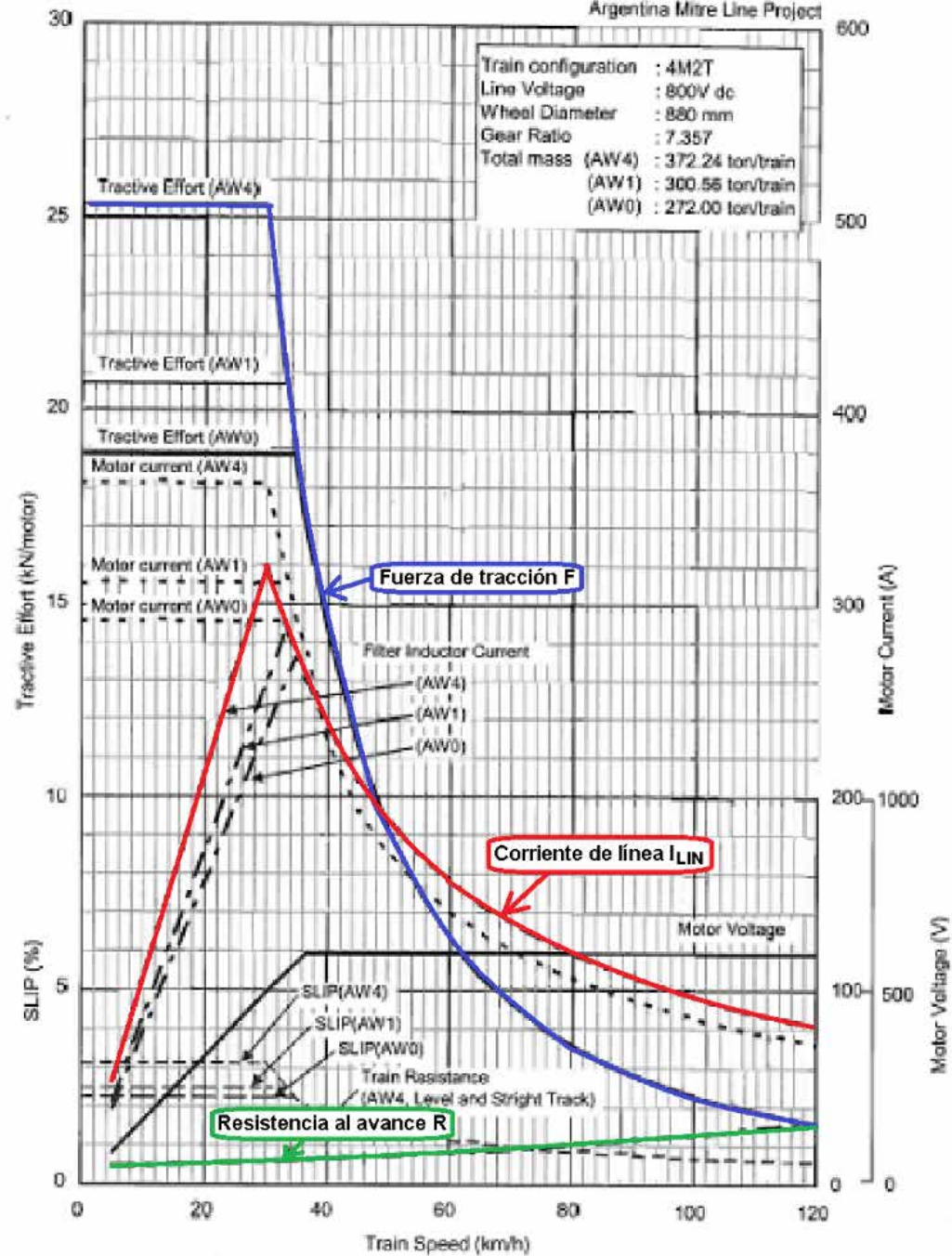
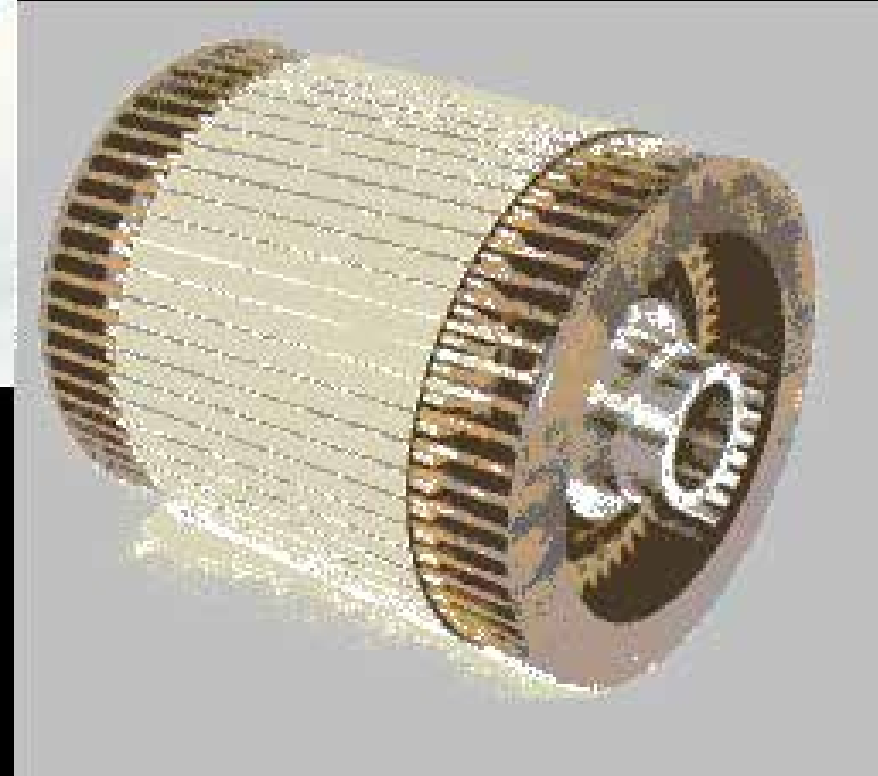


Powering Performance

Argentina Mitre Line Project



MOTOR TRIFÁSICO Y CONTROL VVVF

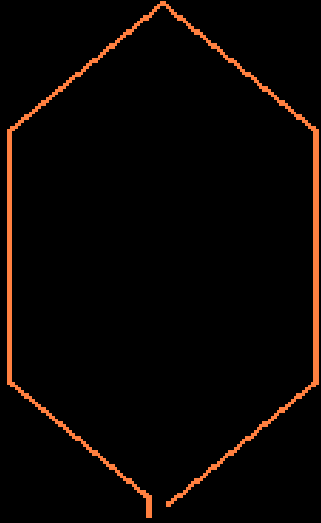


Motor trifásico: estator y rotor

MOTOR DE TRACCIÓN TRIFÁSICO

TOSHIBA 240 kW

BOBINADO



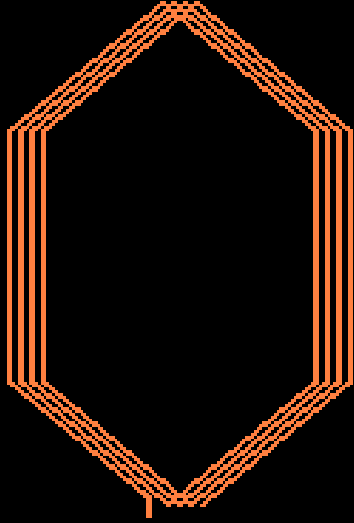
1 espira



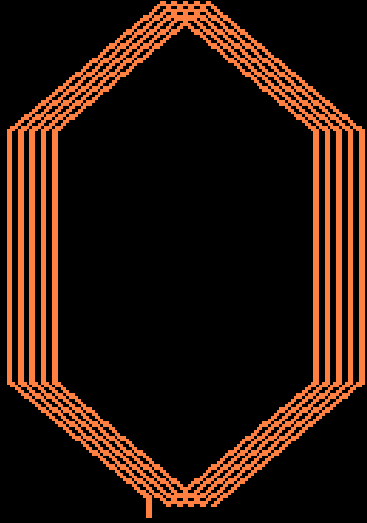
2 espiras



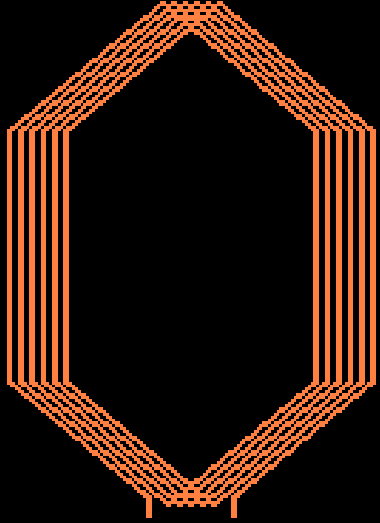
3 espiras



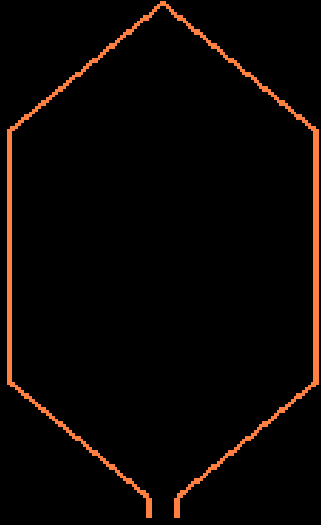
4 espiras



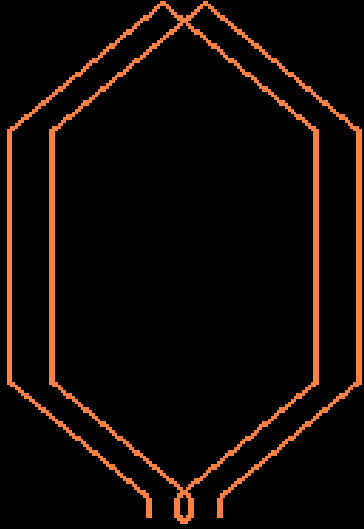
5 espiras



6 espiras por bobina



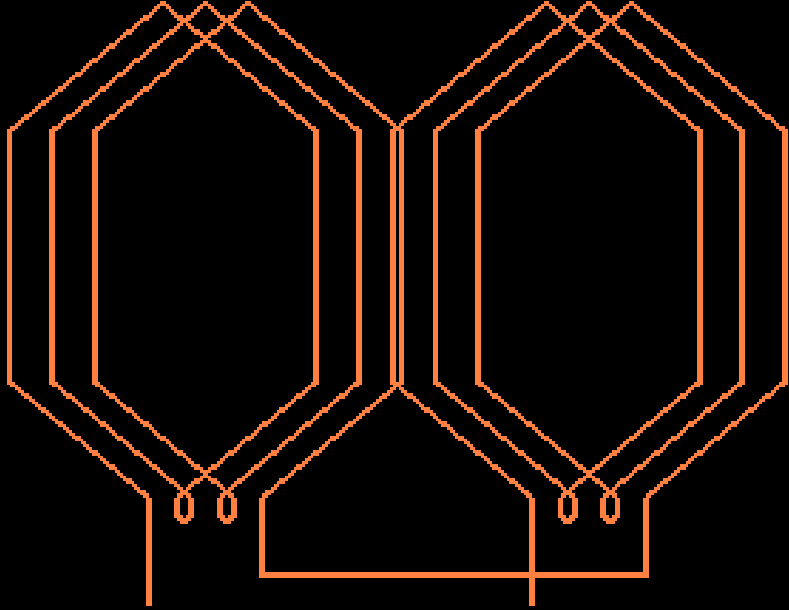
1 bobina



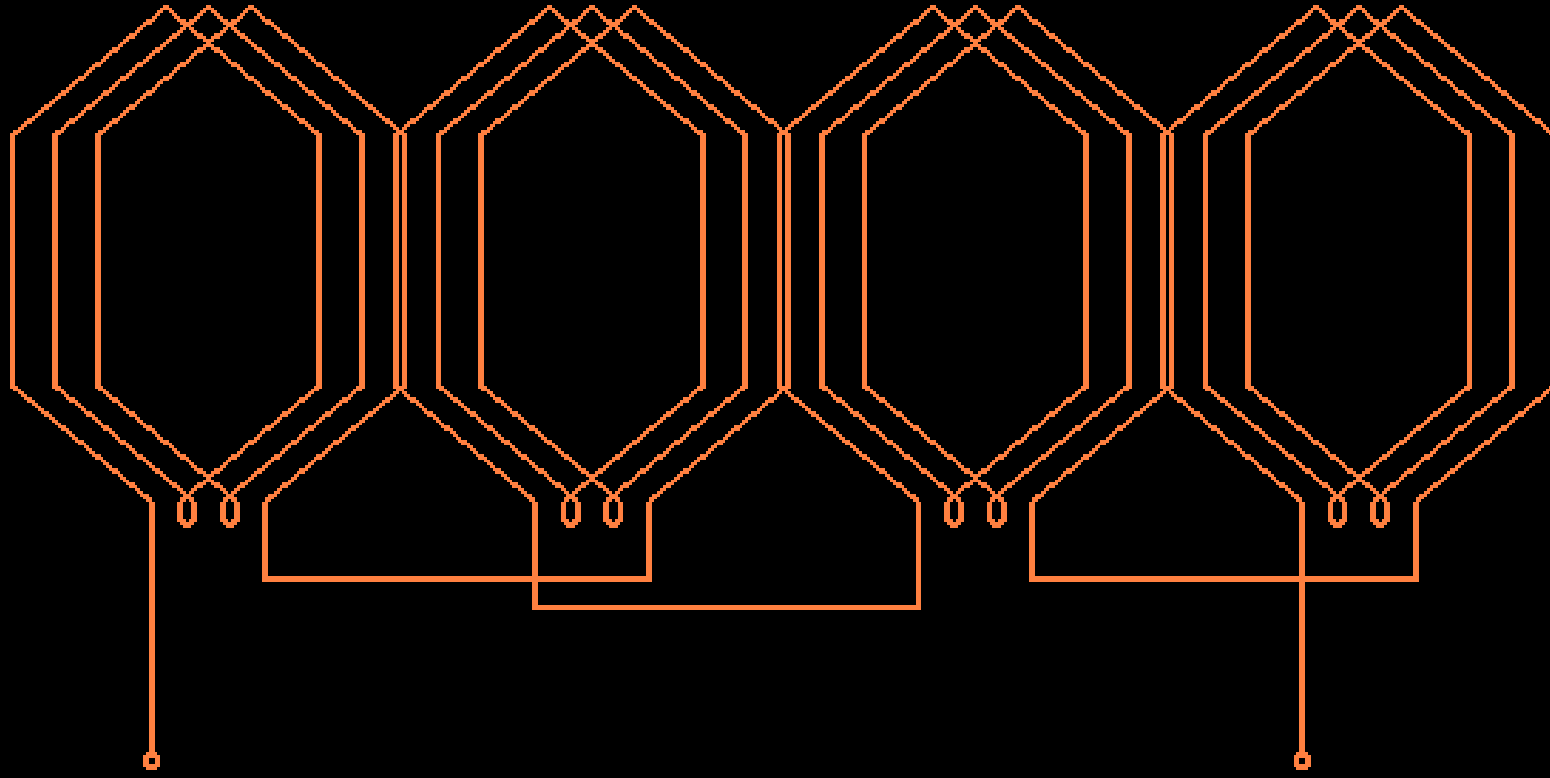
2 bobinas



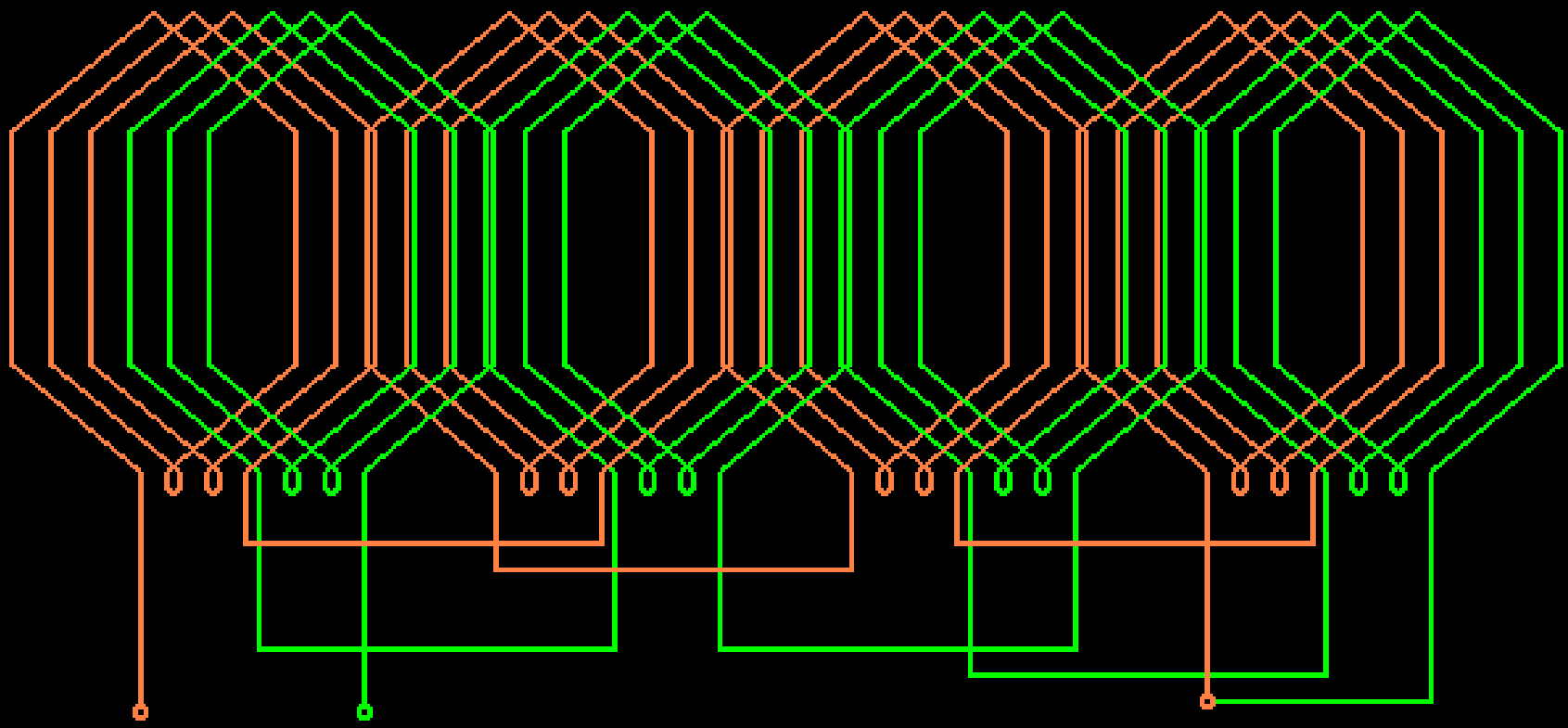
3 bobinas por polo



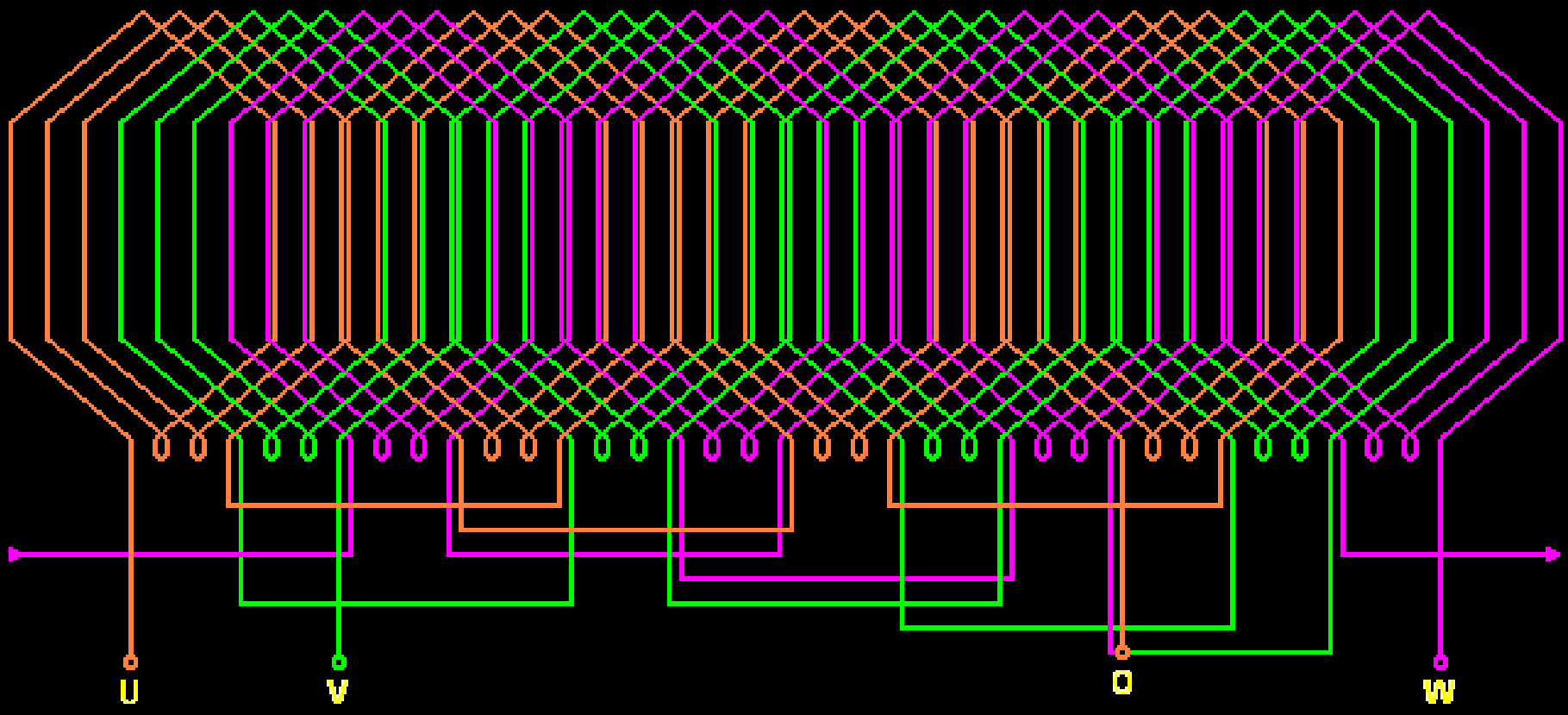
2 polos



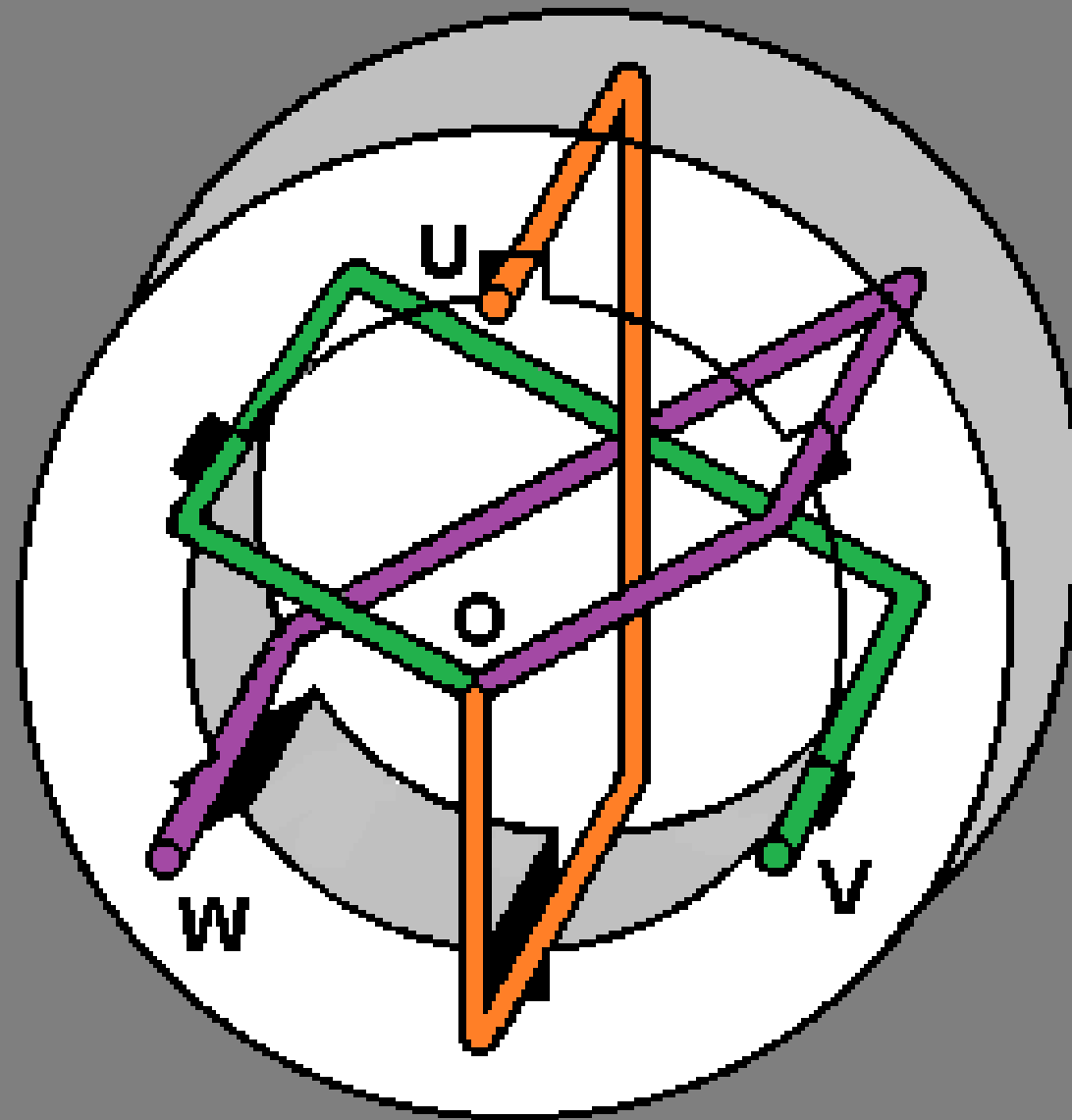
4 polos – 1 fase



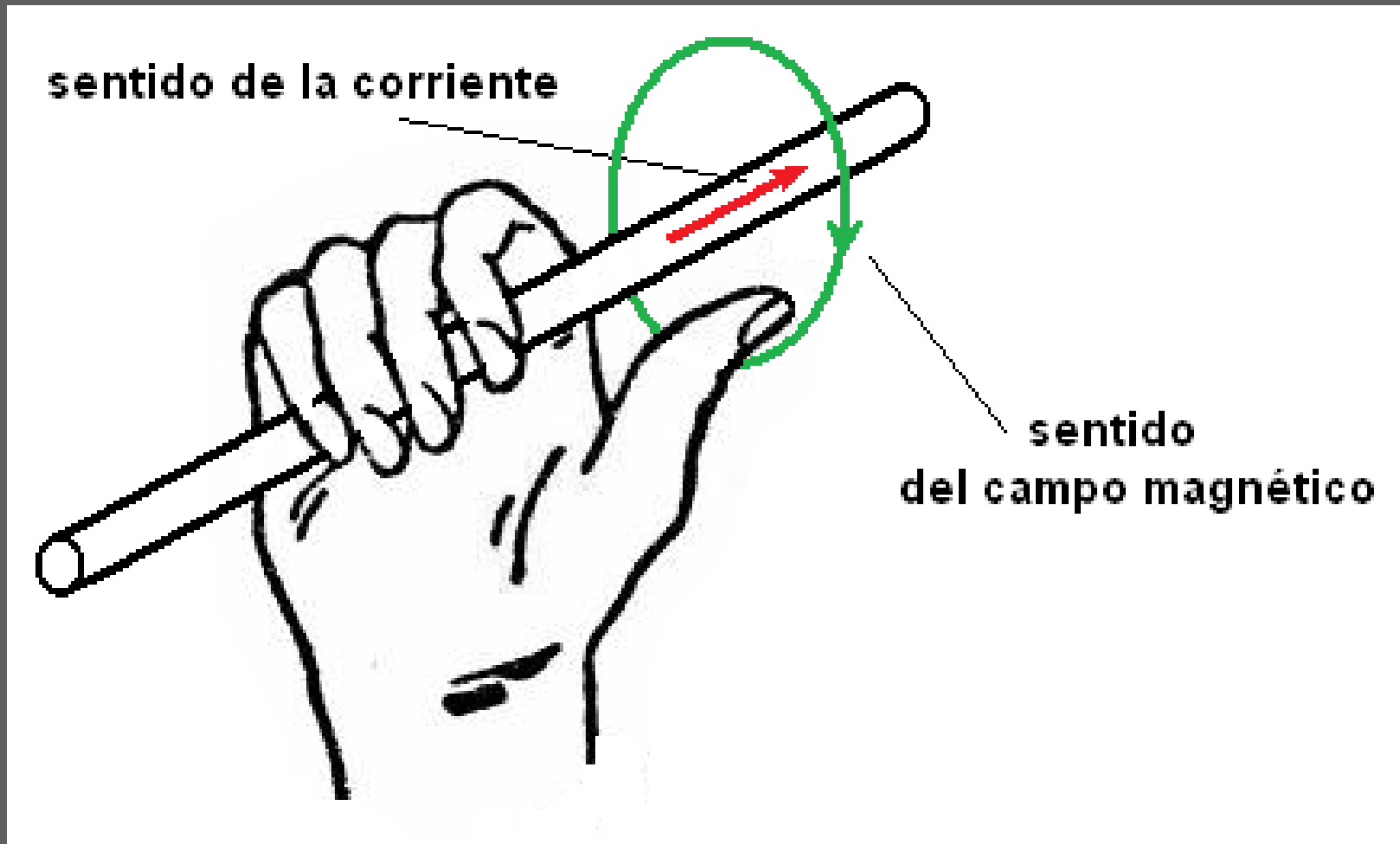
2 fases



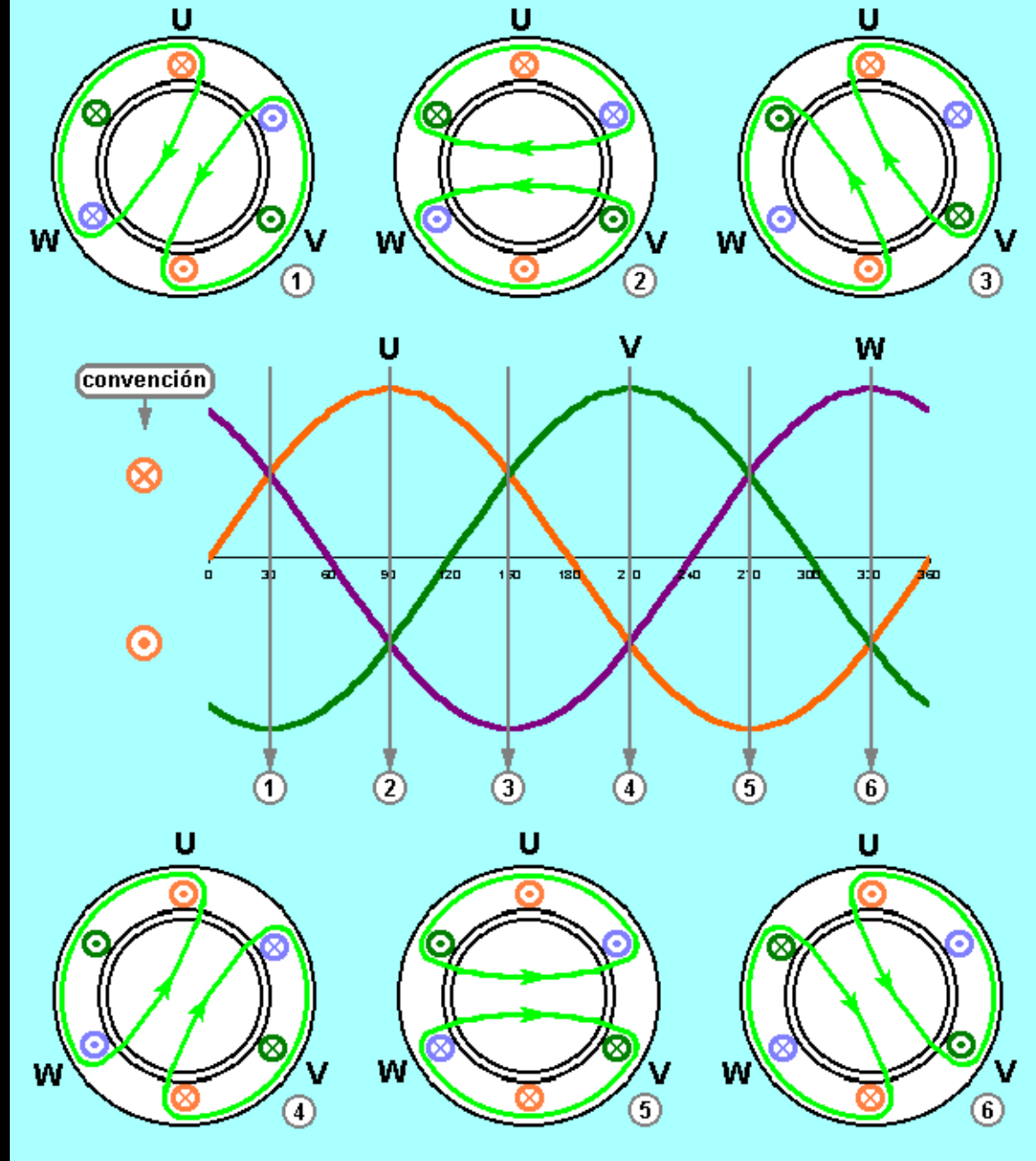
3 fases



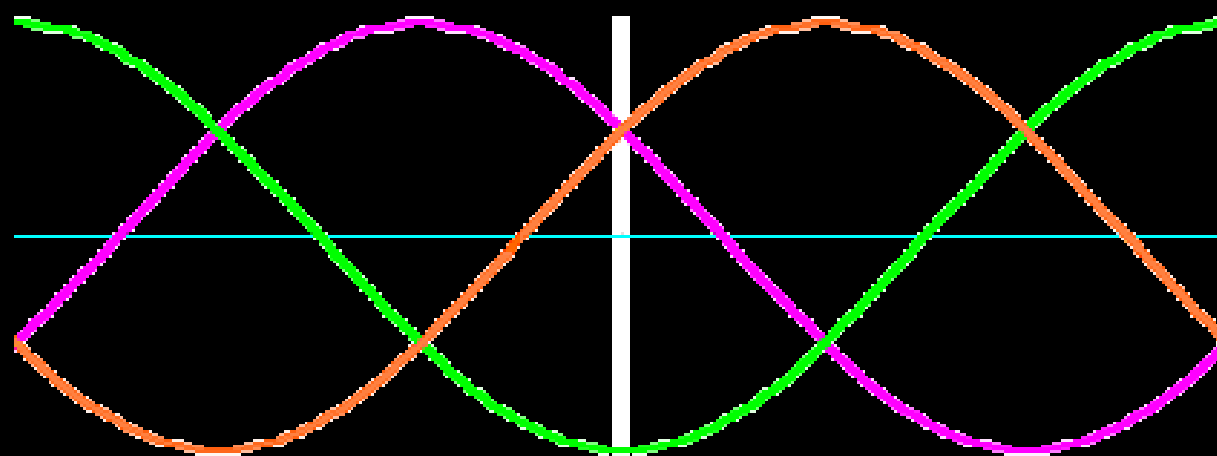
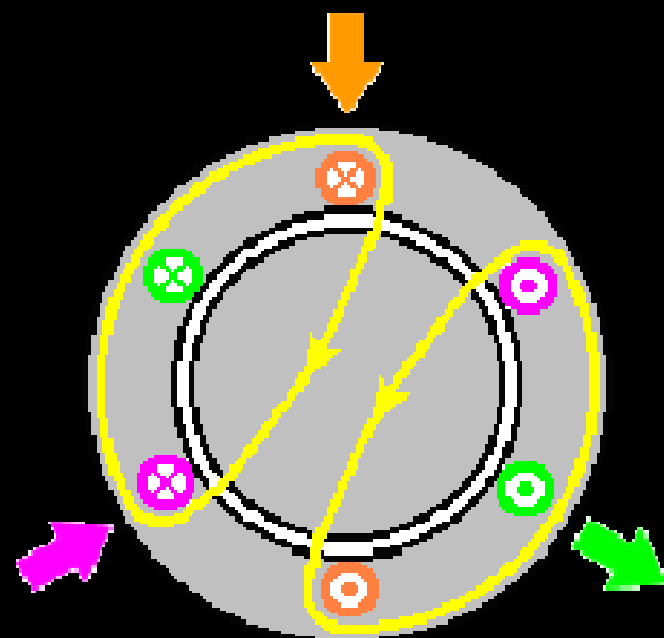
Devanado elemental: una sola espira por fase

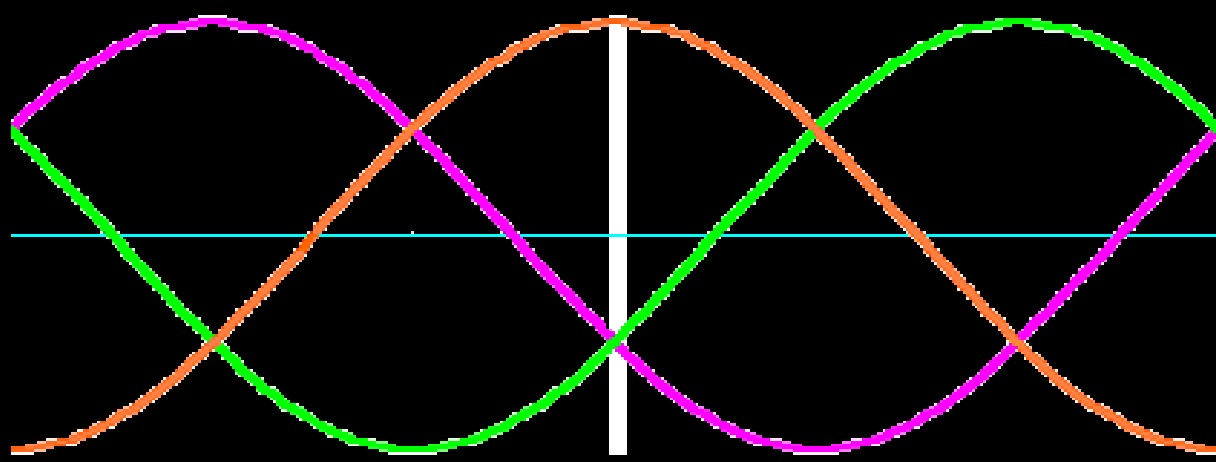
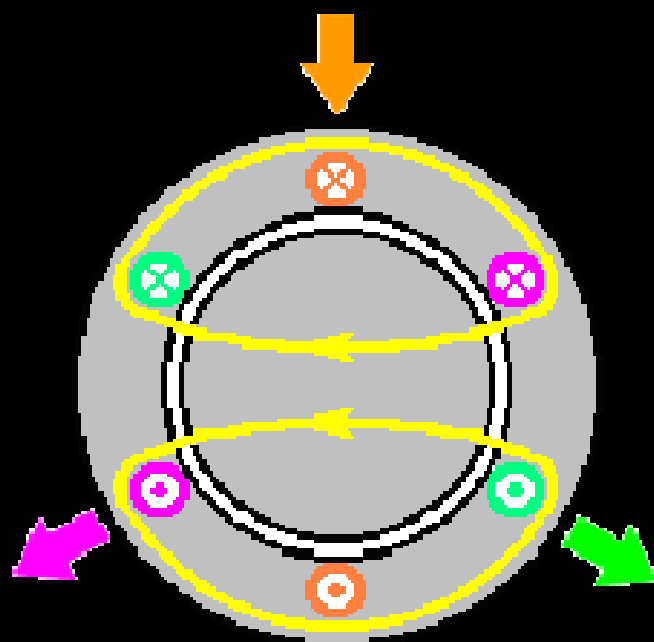


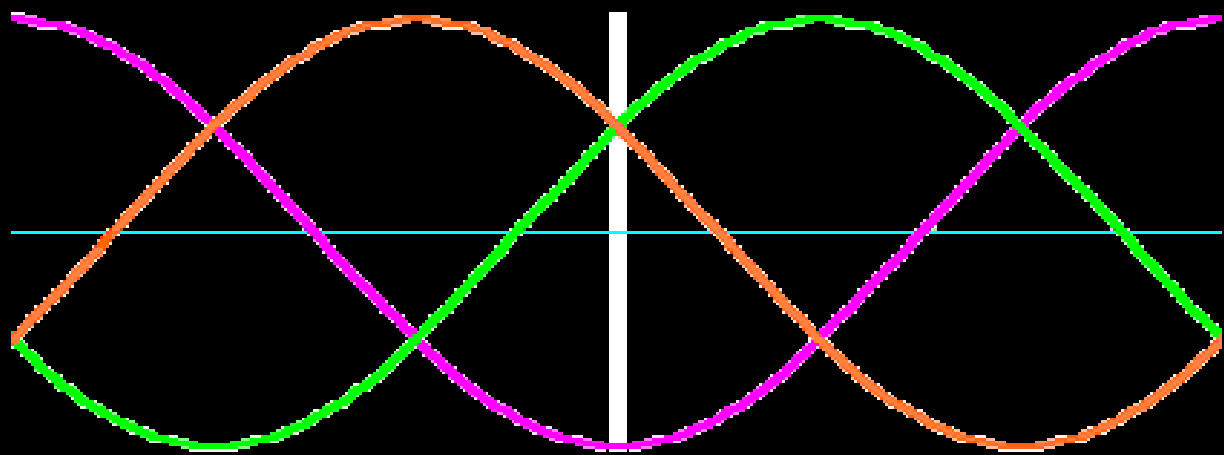
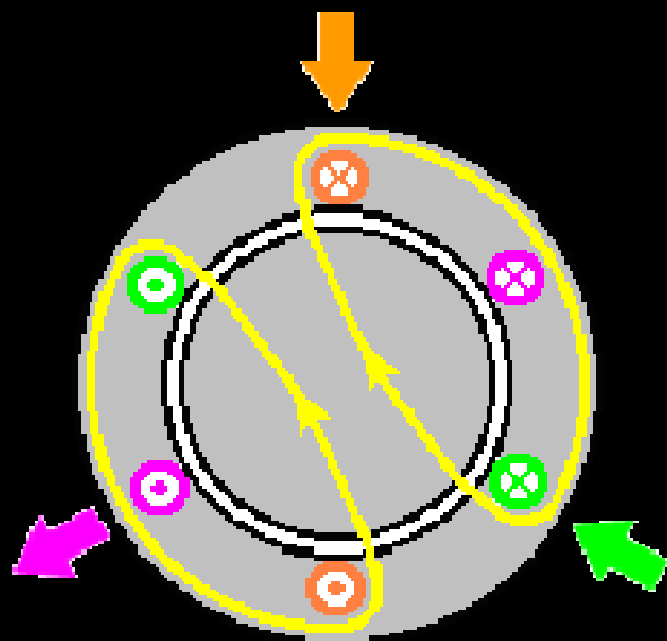
Regla del tornillo

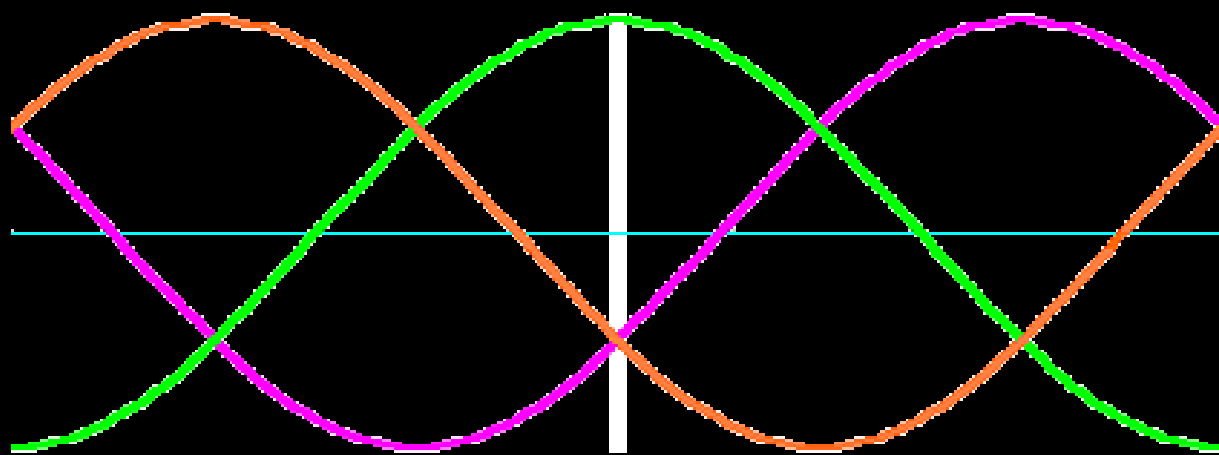
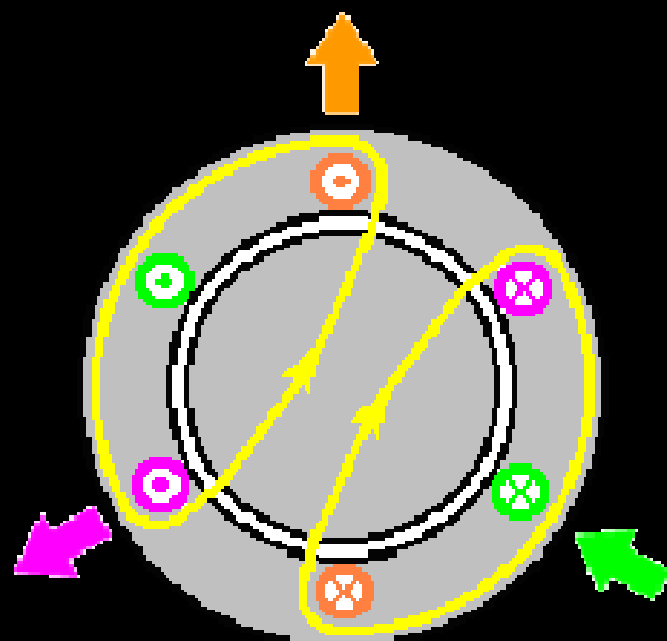


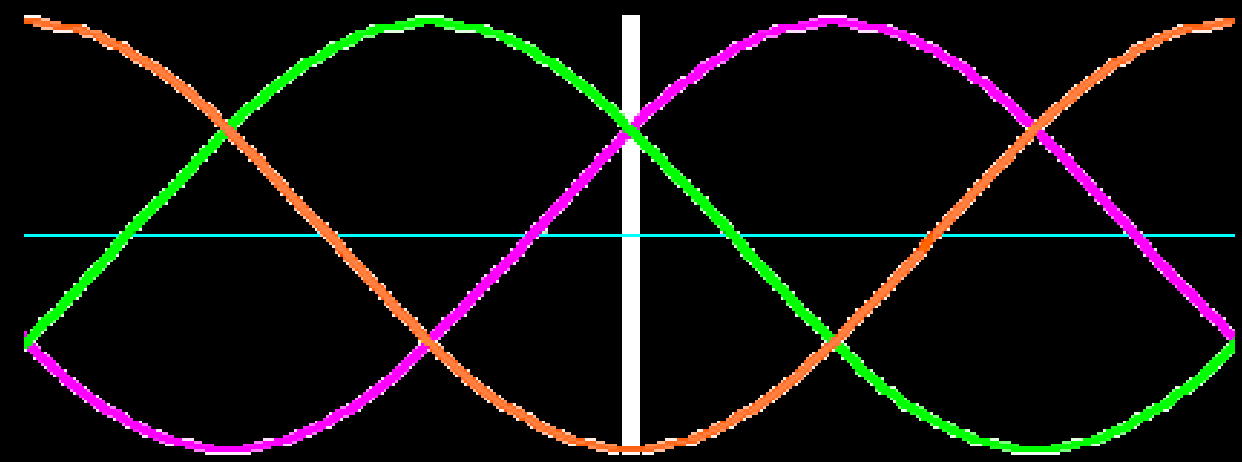
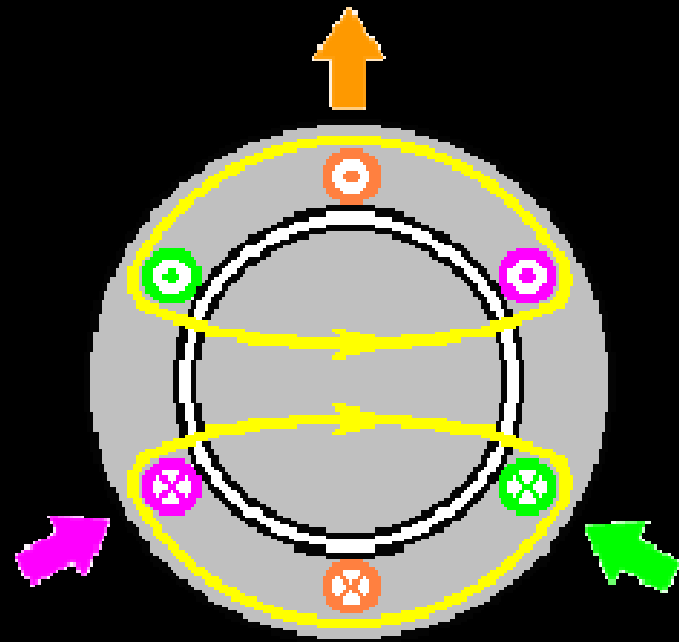
Generación de un campo rotante

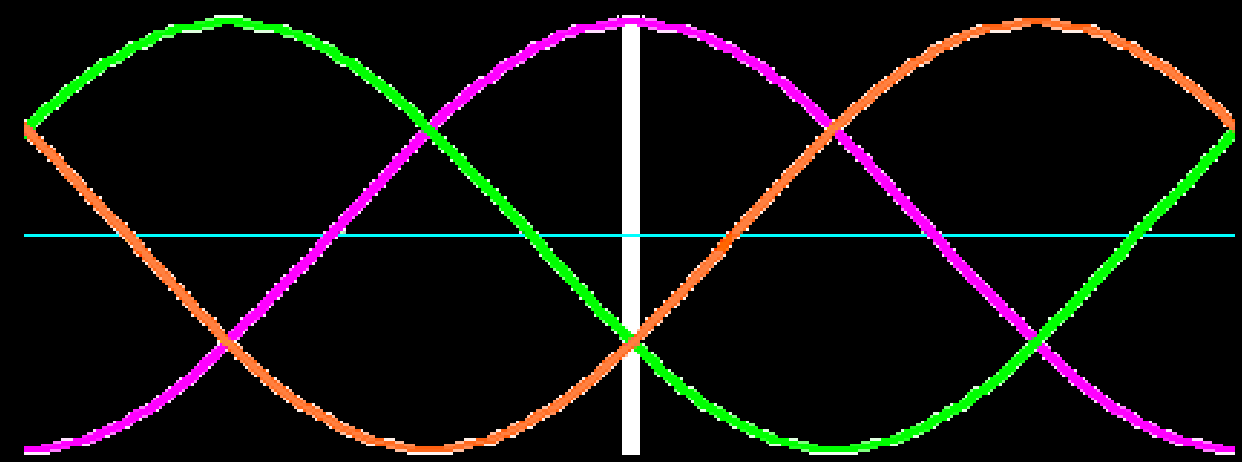
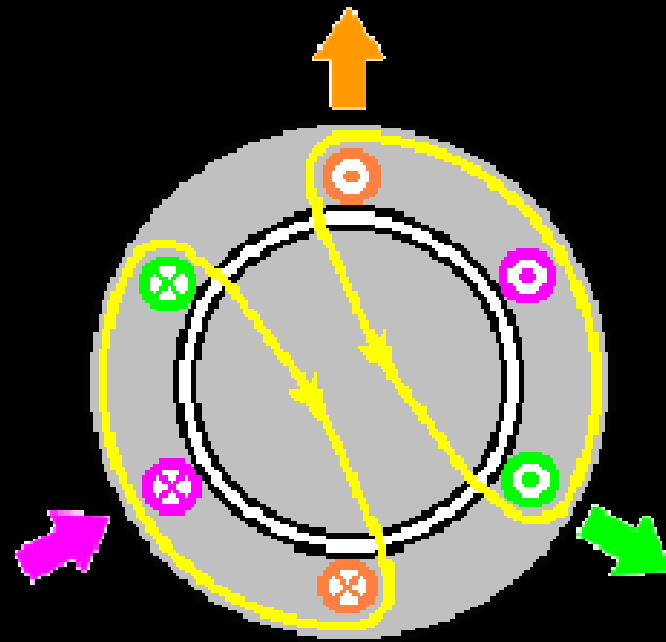


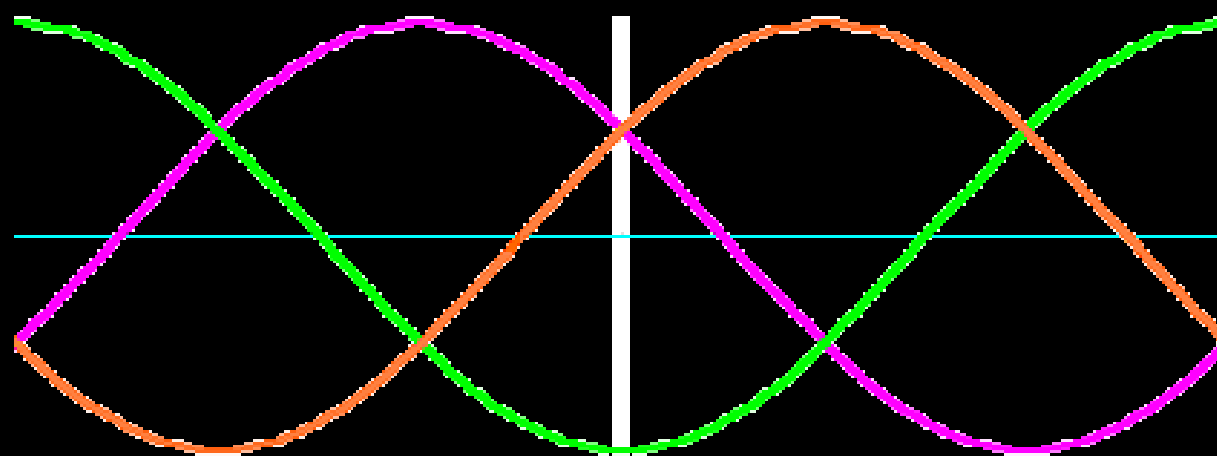
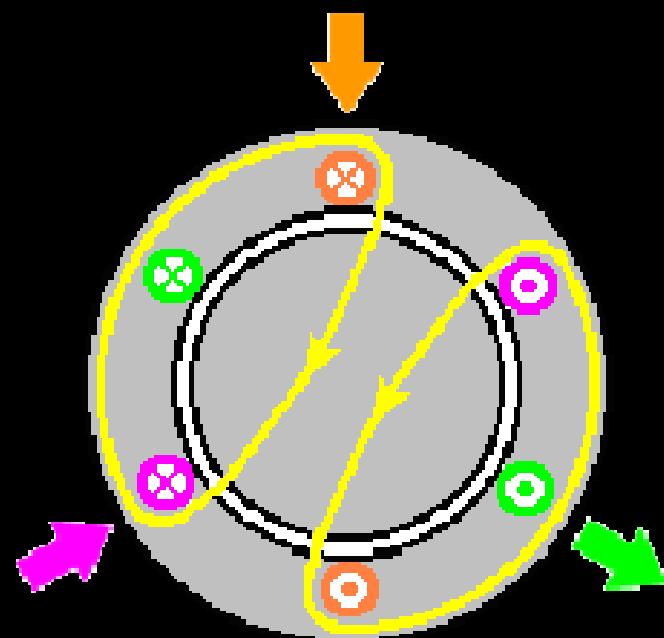


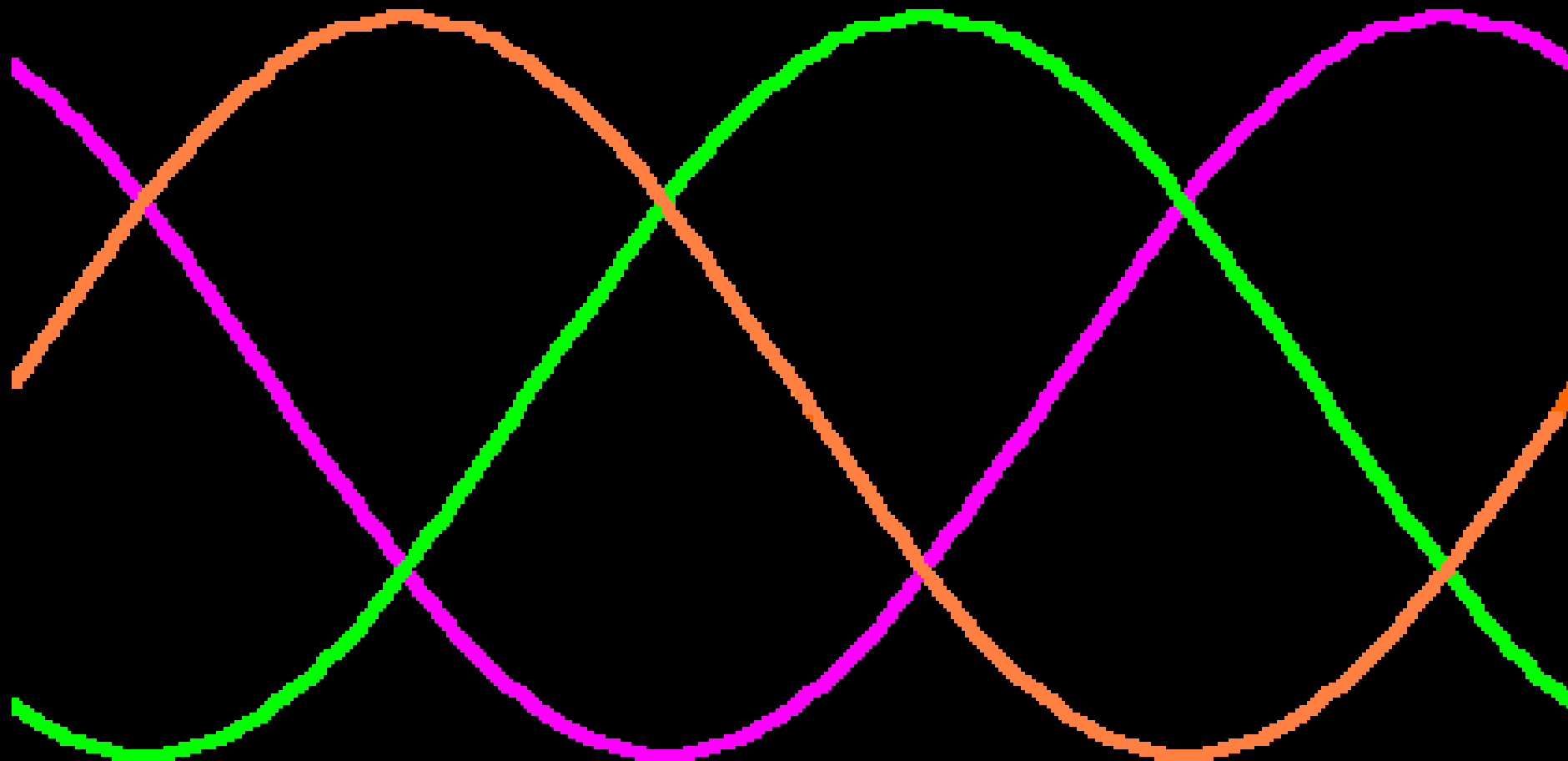




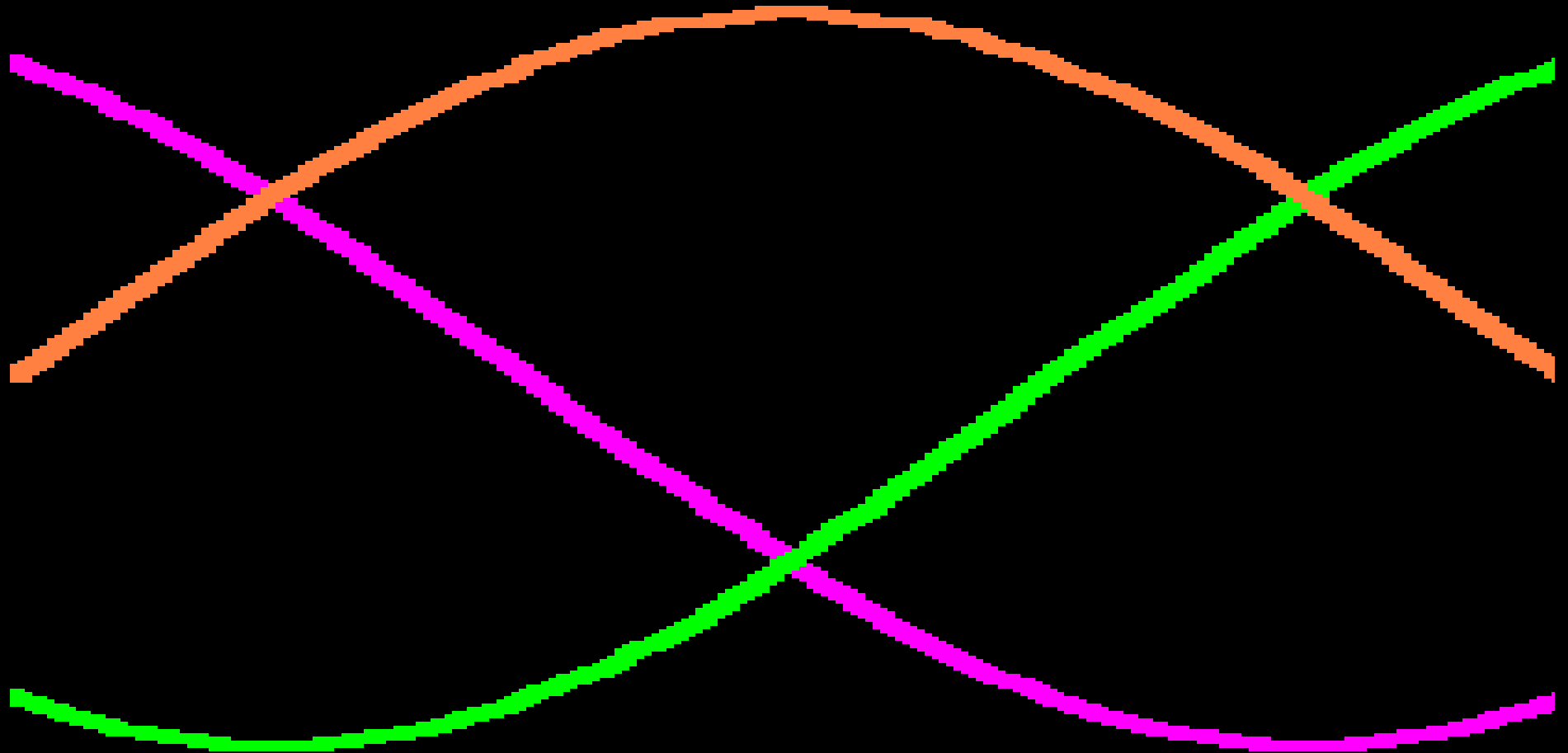




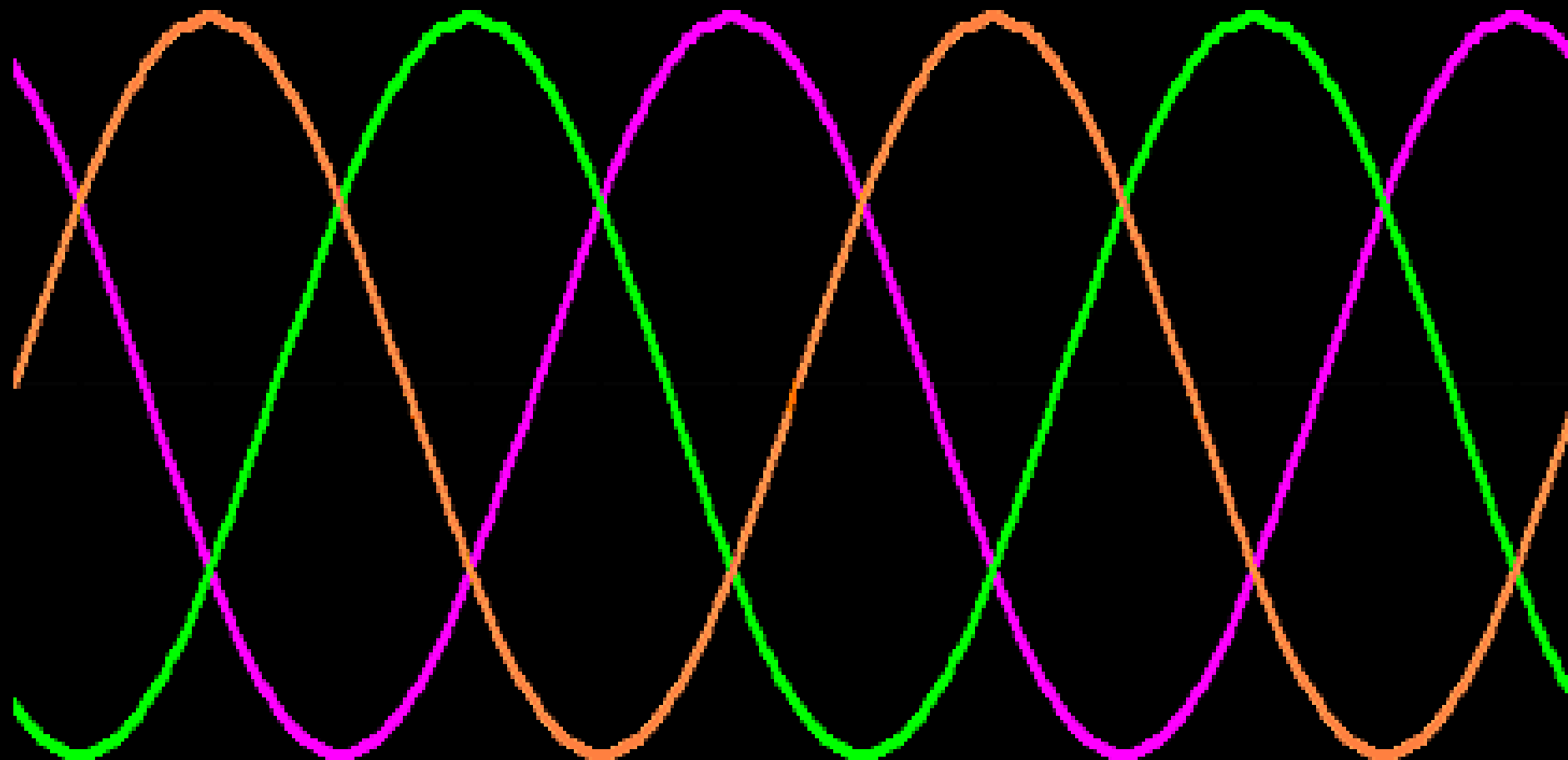




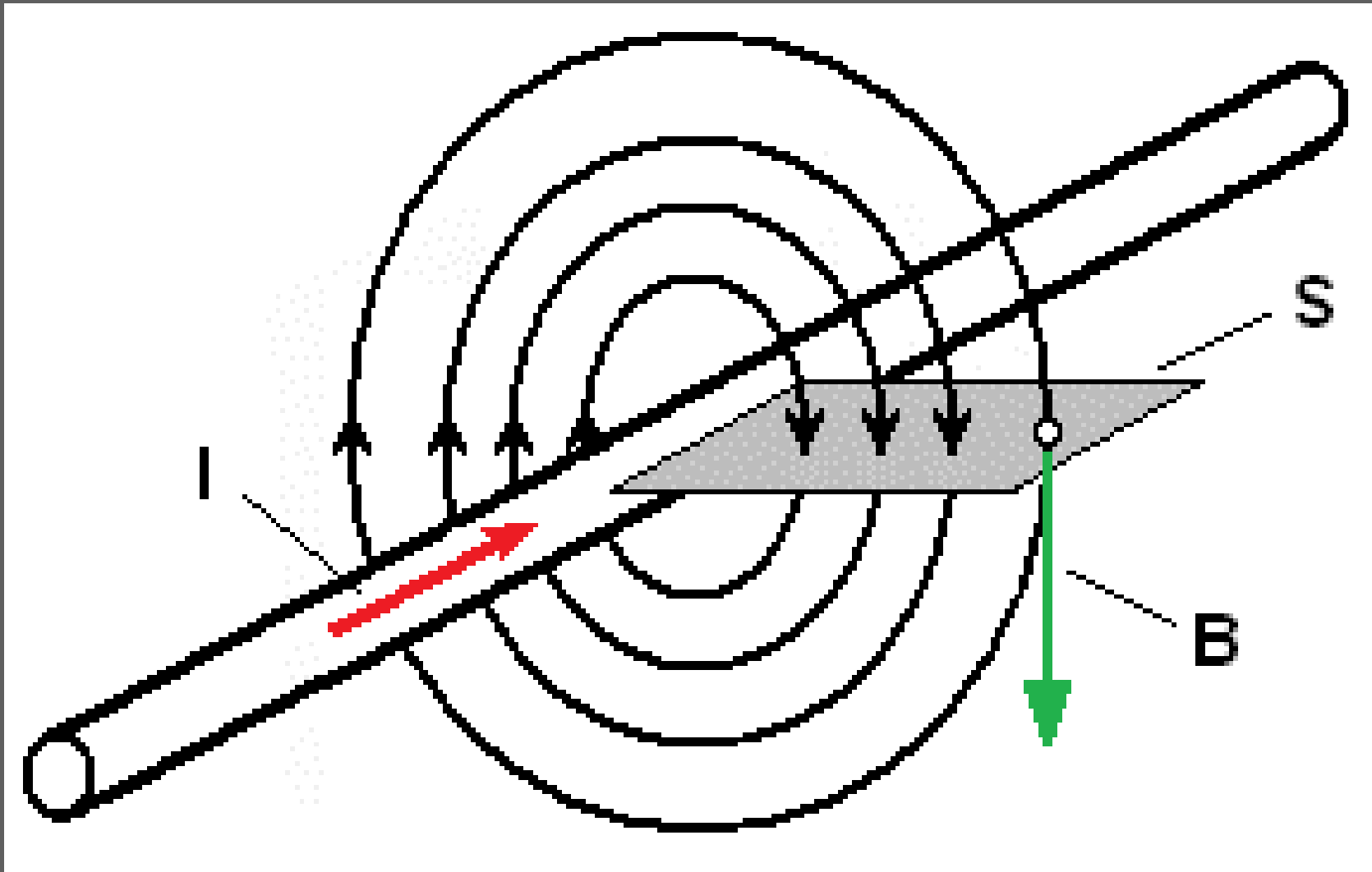
Frecuencia nominal



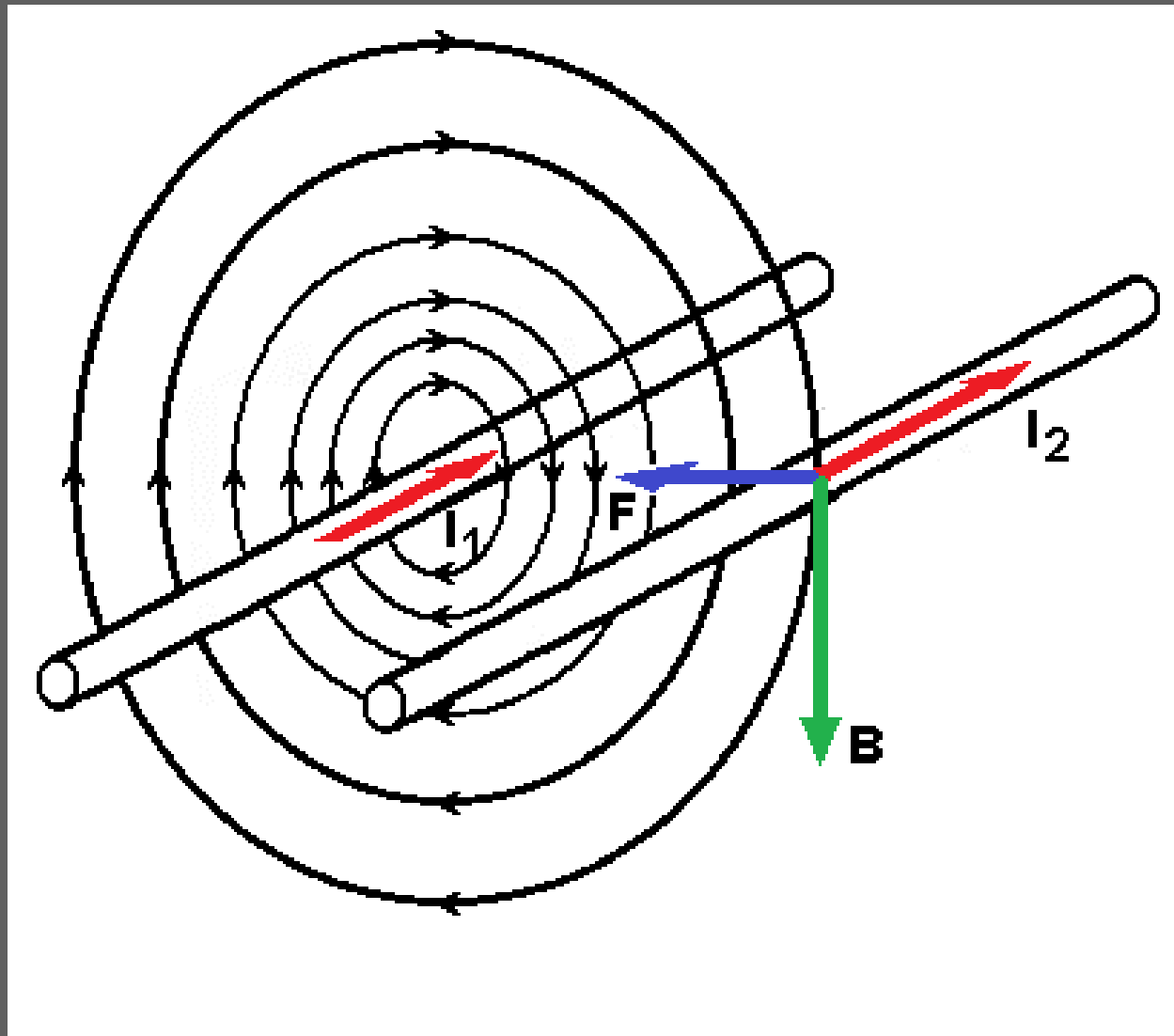
Frecuencia mitad



Frecuencia doble

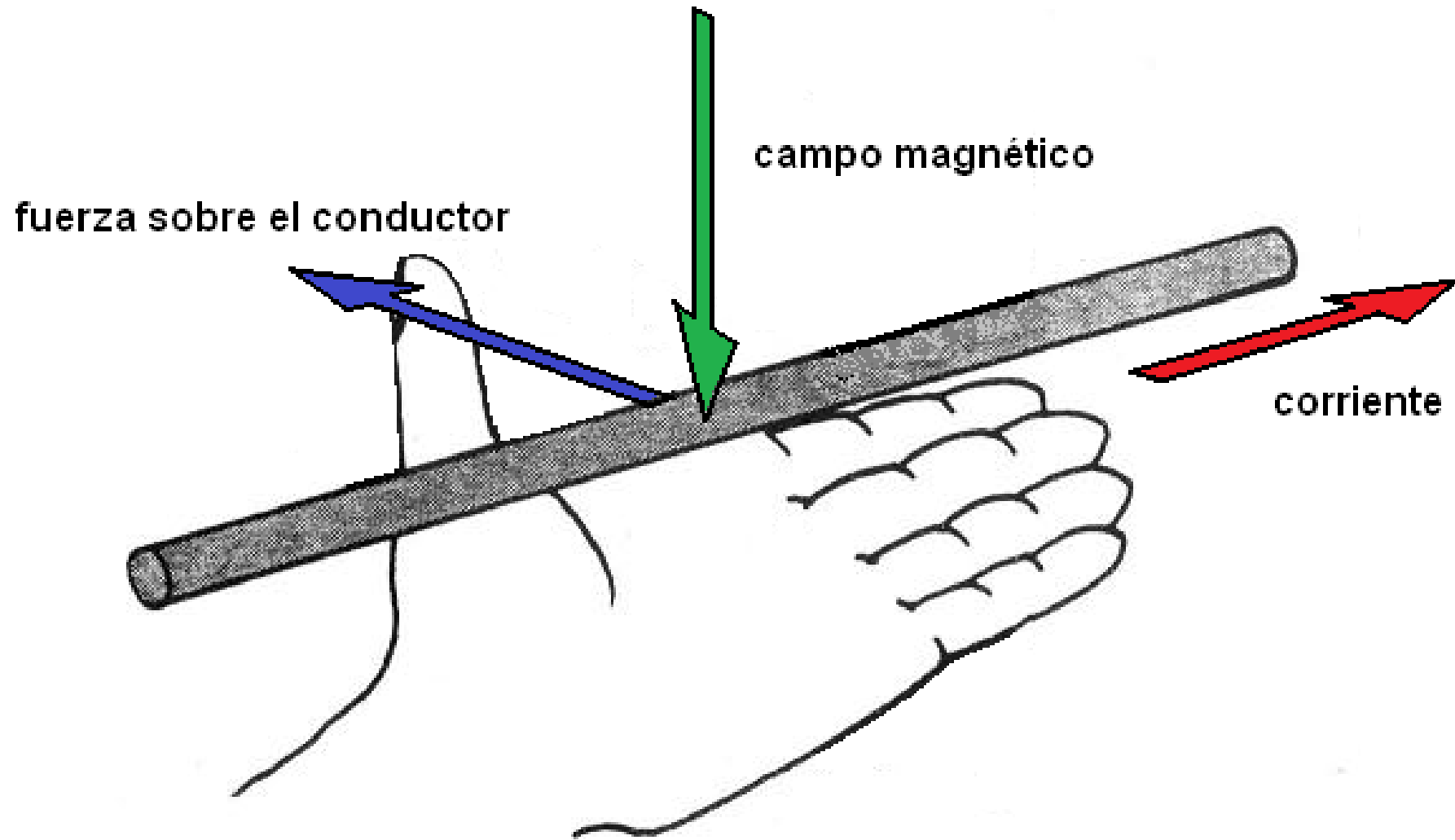


Flujo del campo magnético: $F = B \cdot S$

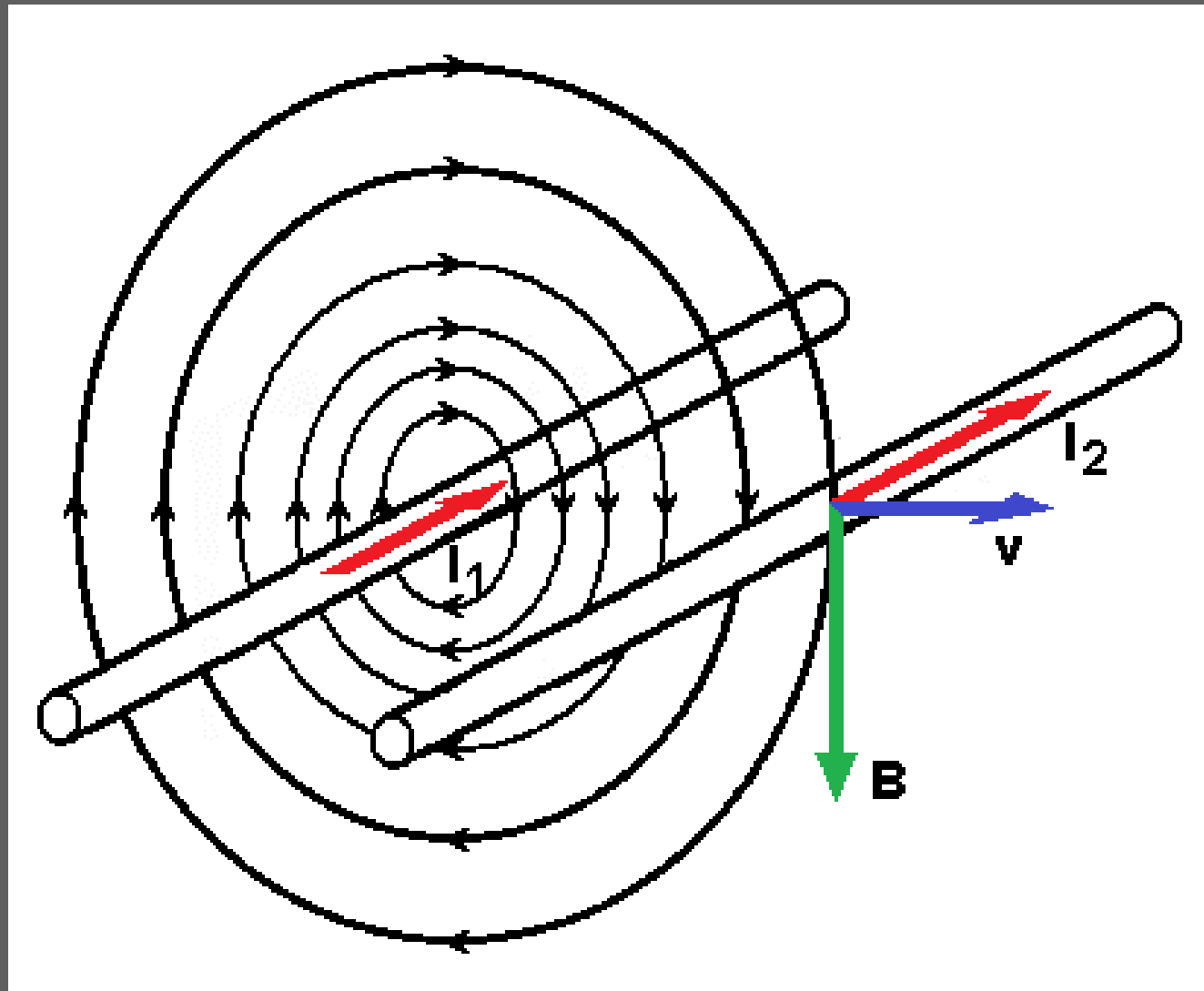


Fuerza entre conductores recorridos por corrientes:

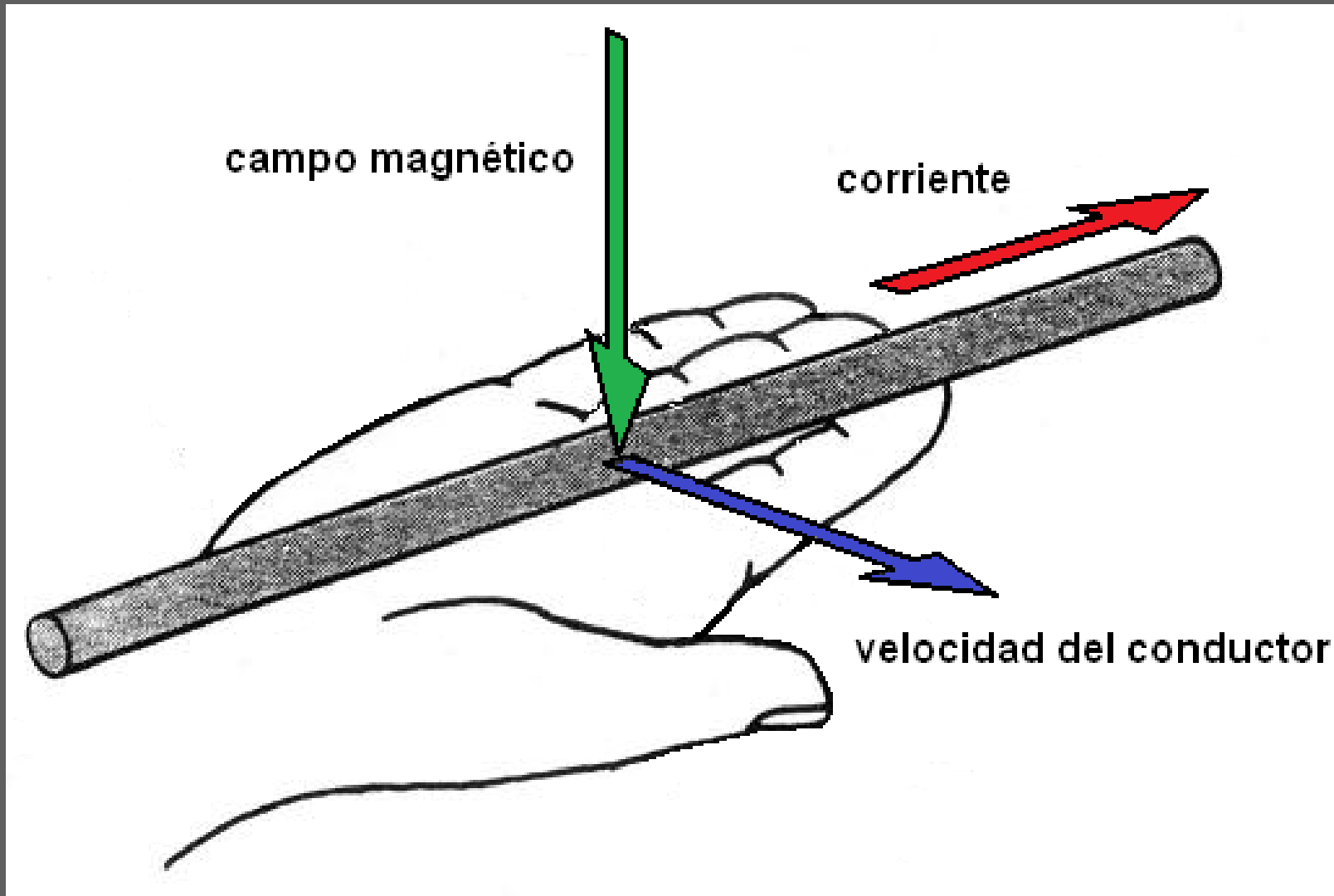
$$F \sim B \cdot I$$



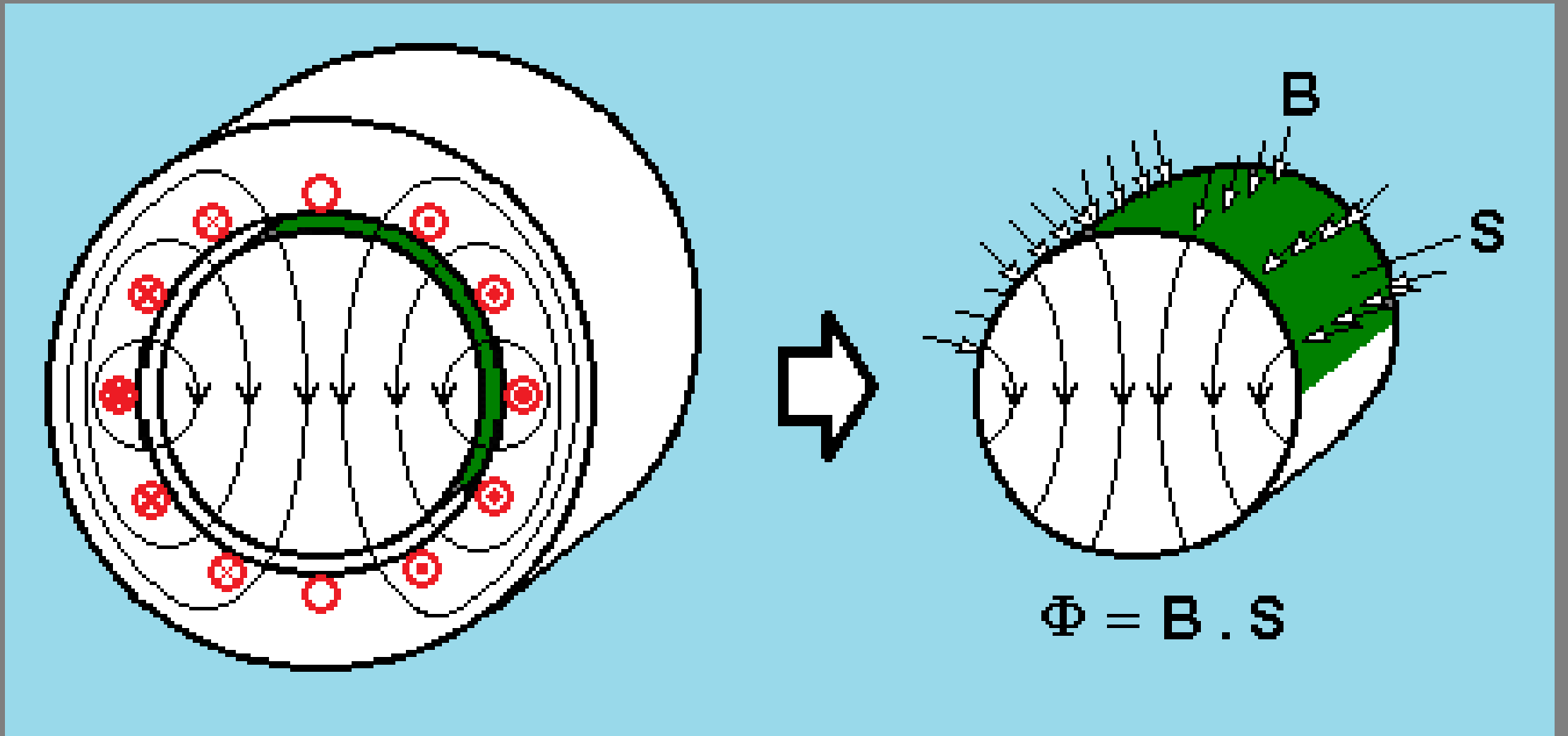
Regla de la mano izquierda



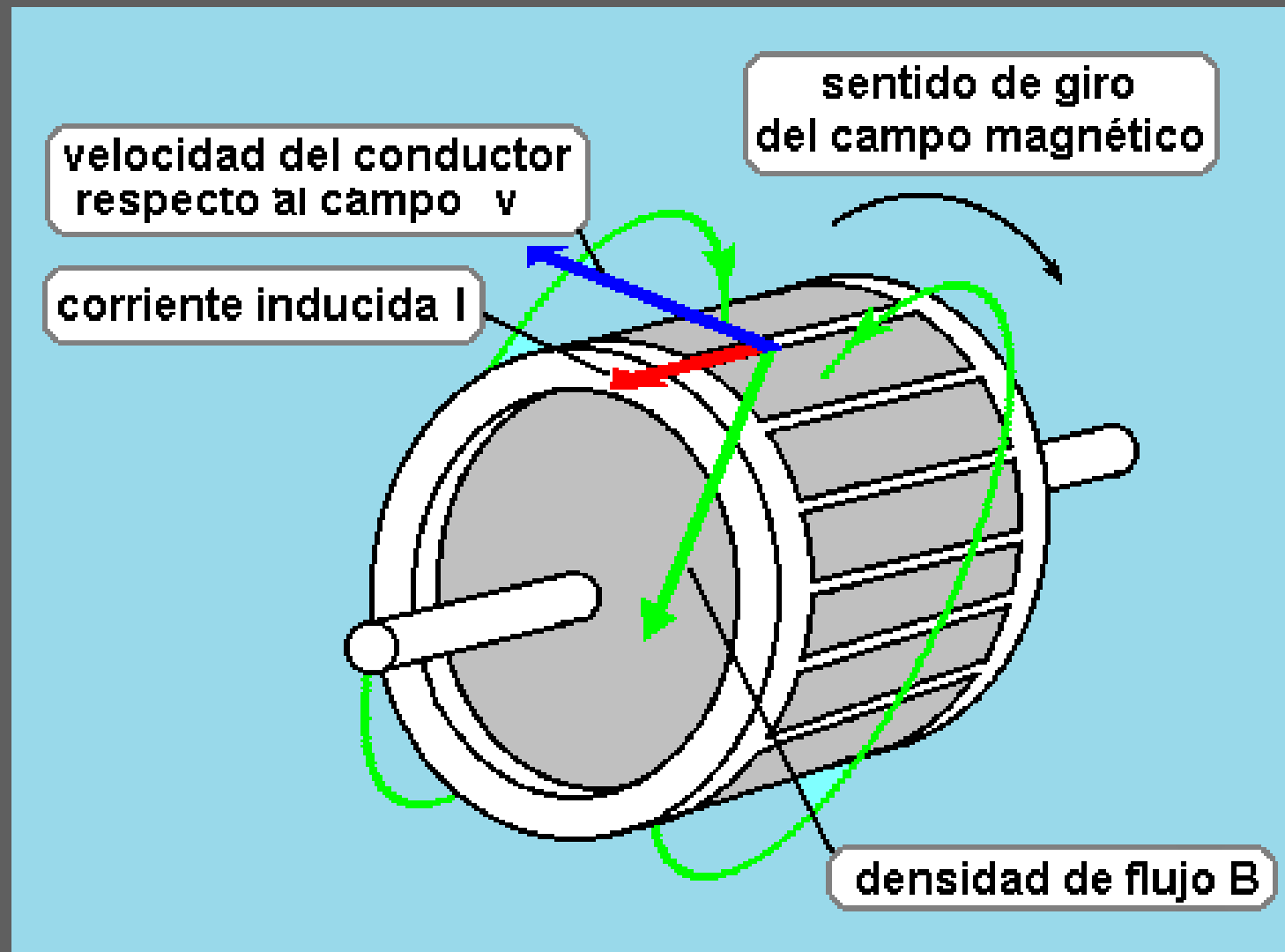
Tensión inducida en un conductor
que se mueve respecto al campo magnético: $E \sim B \cdot v$



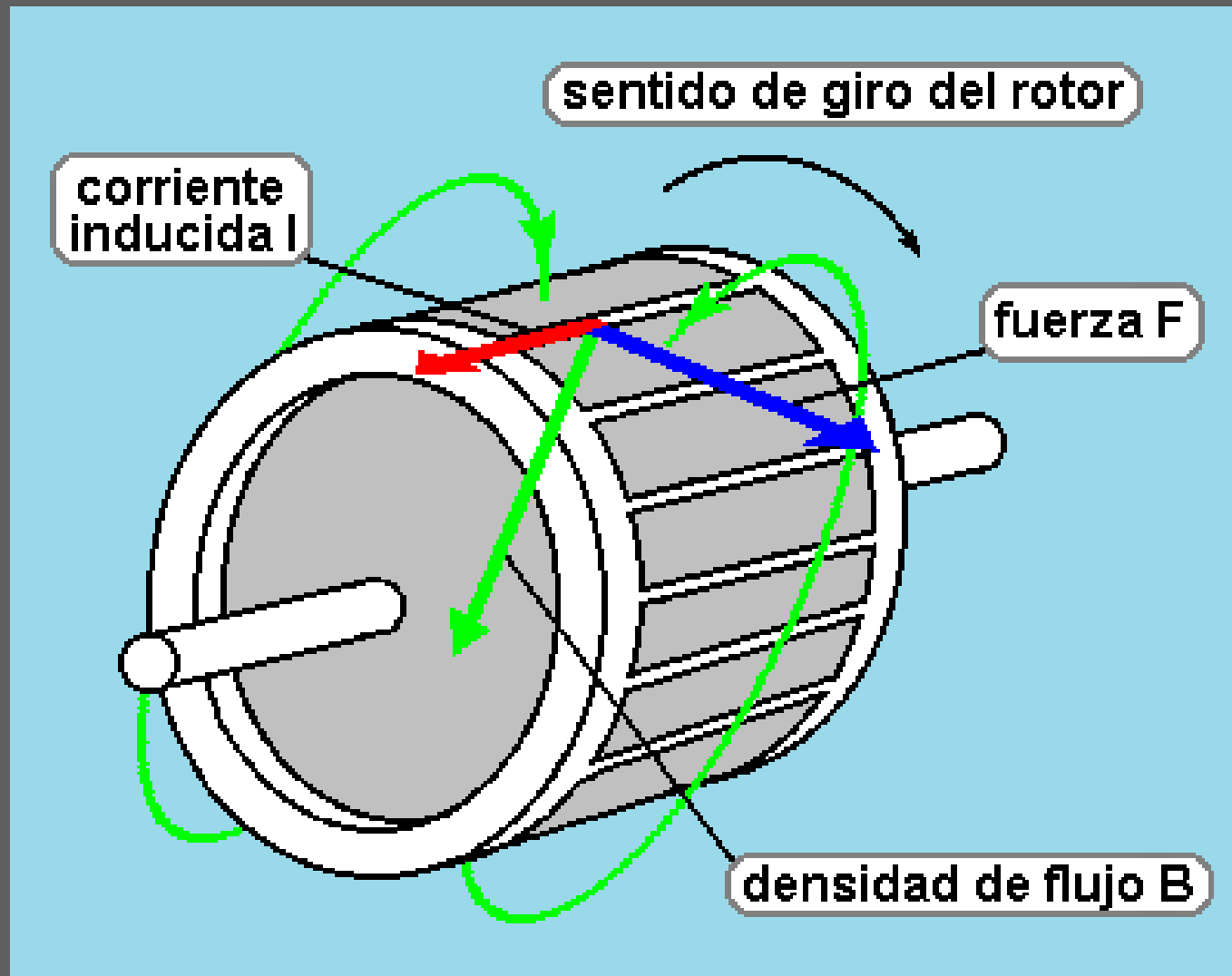
Regla de la mano derecha



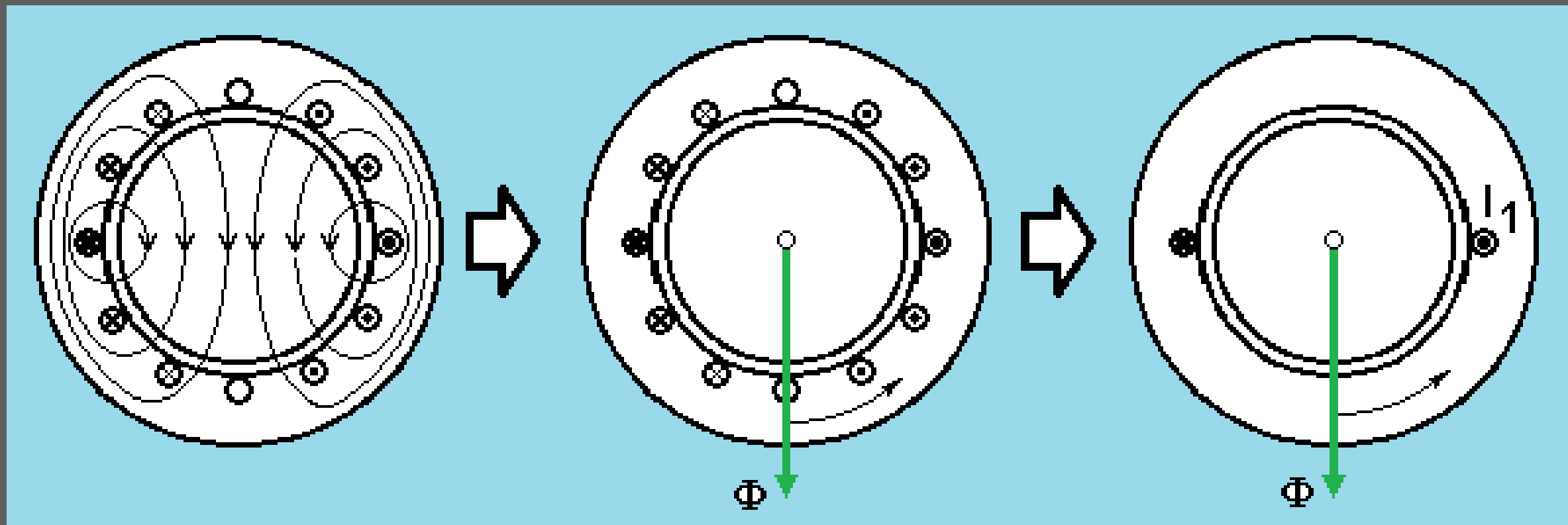
Flujo en el rotor



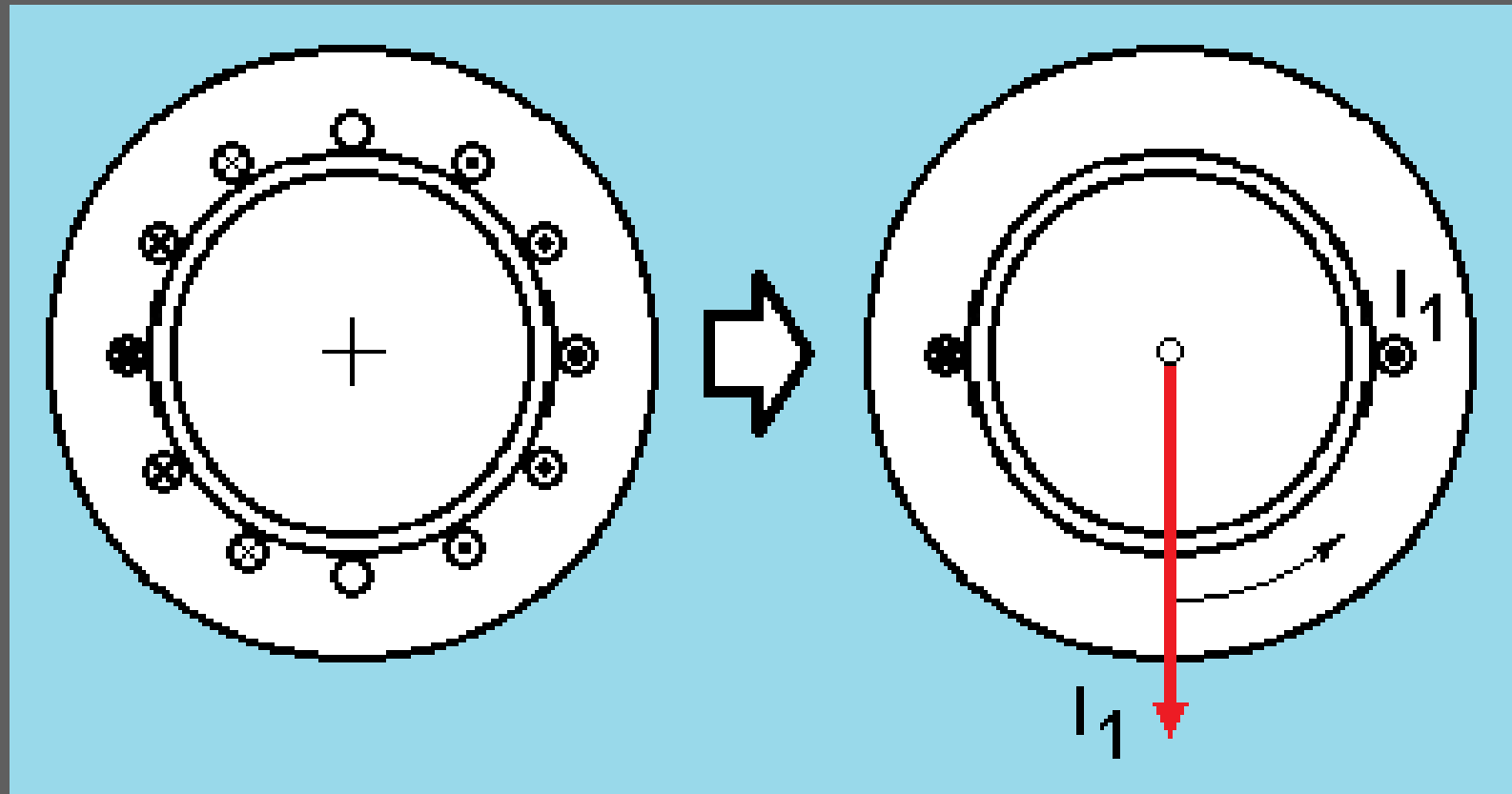
Tensión inducida en el rotor: $E \sim F \cdot n$



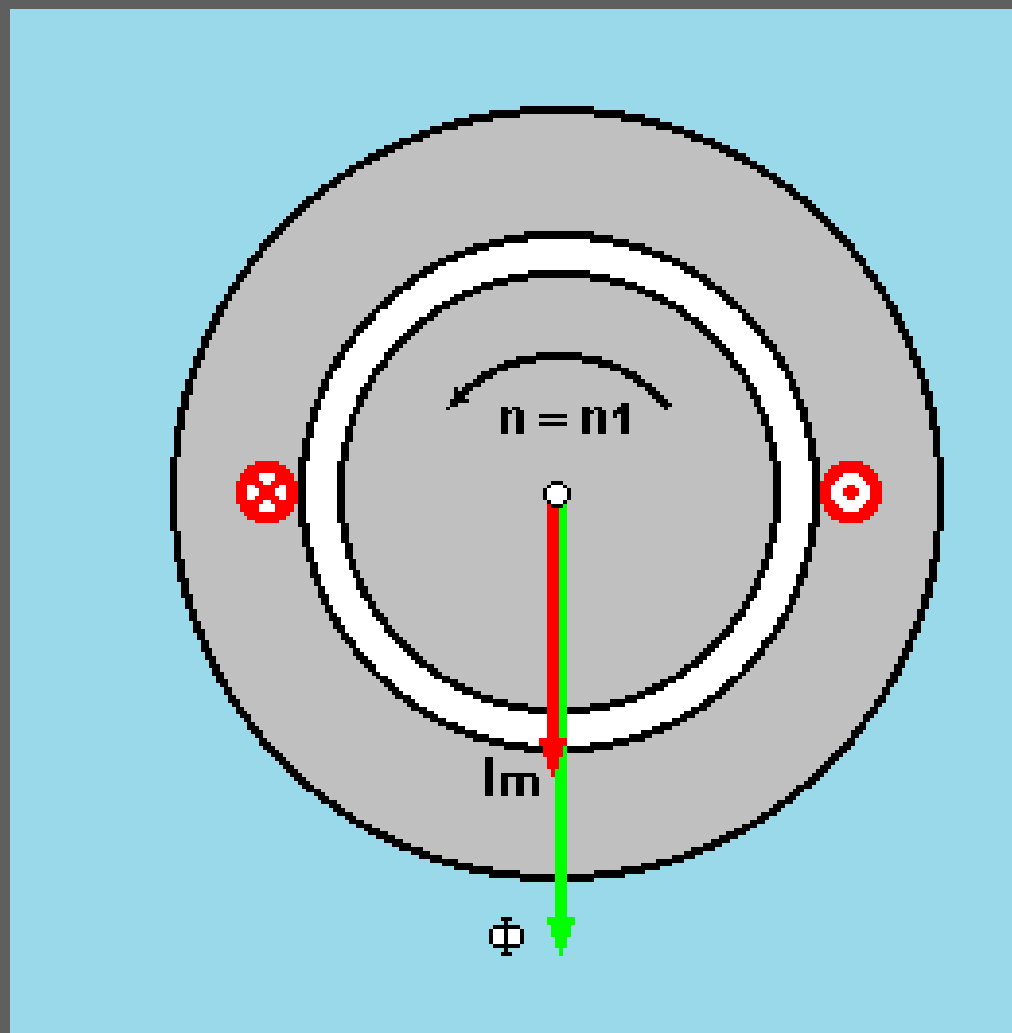
$$\text{Par en el rotor: } T = F \cdot r \\ \sim F \cdot l$$



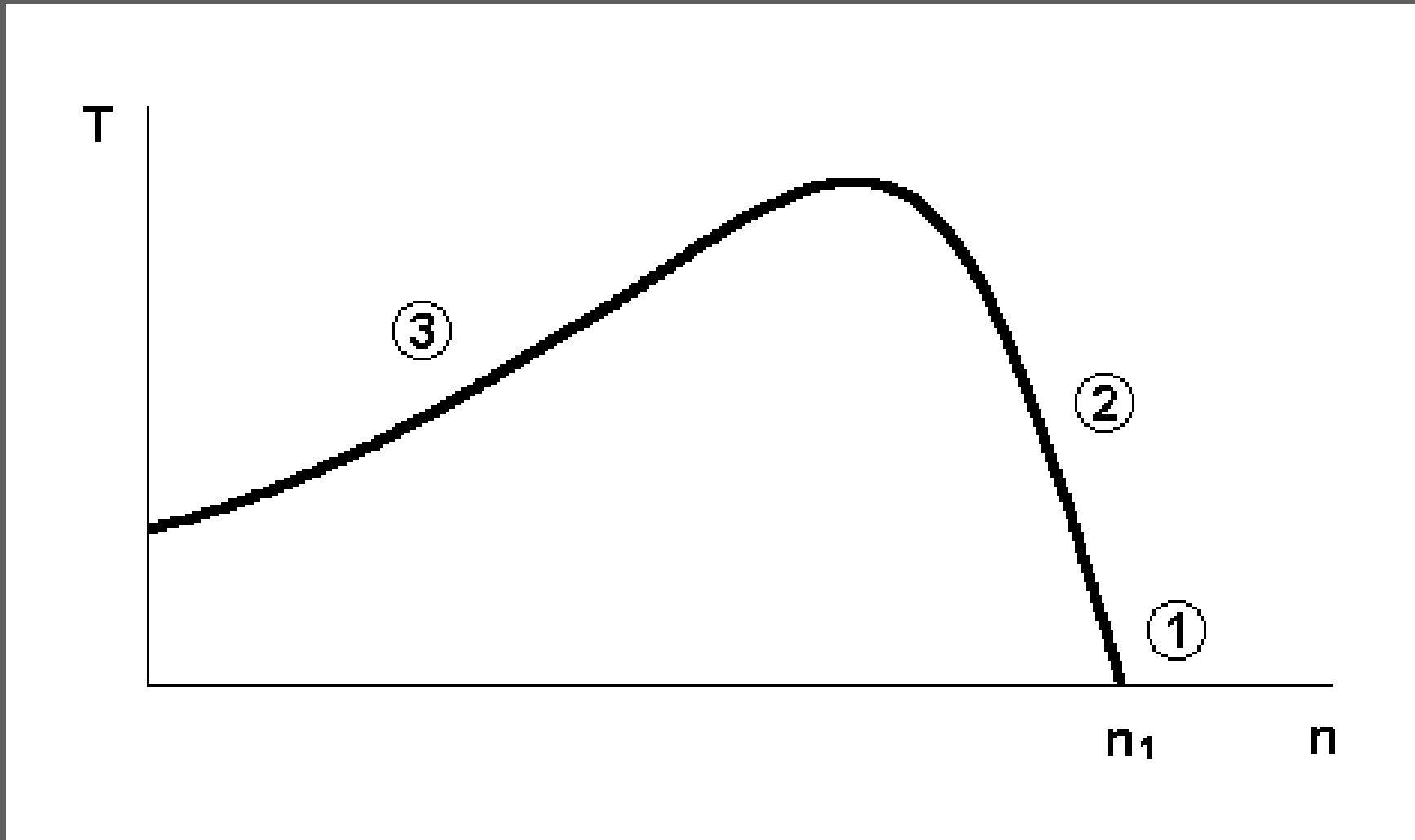
Convención para representar el flujo



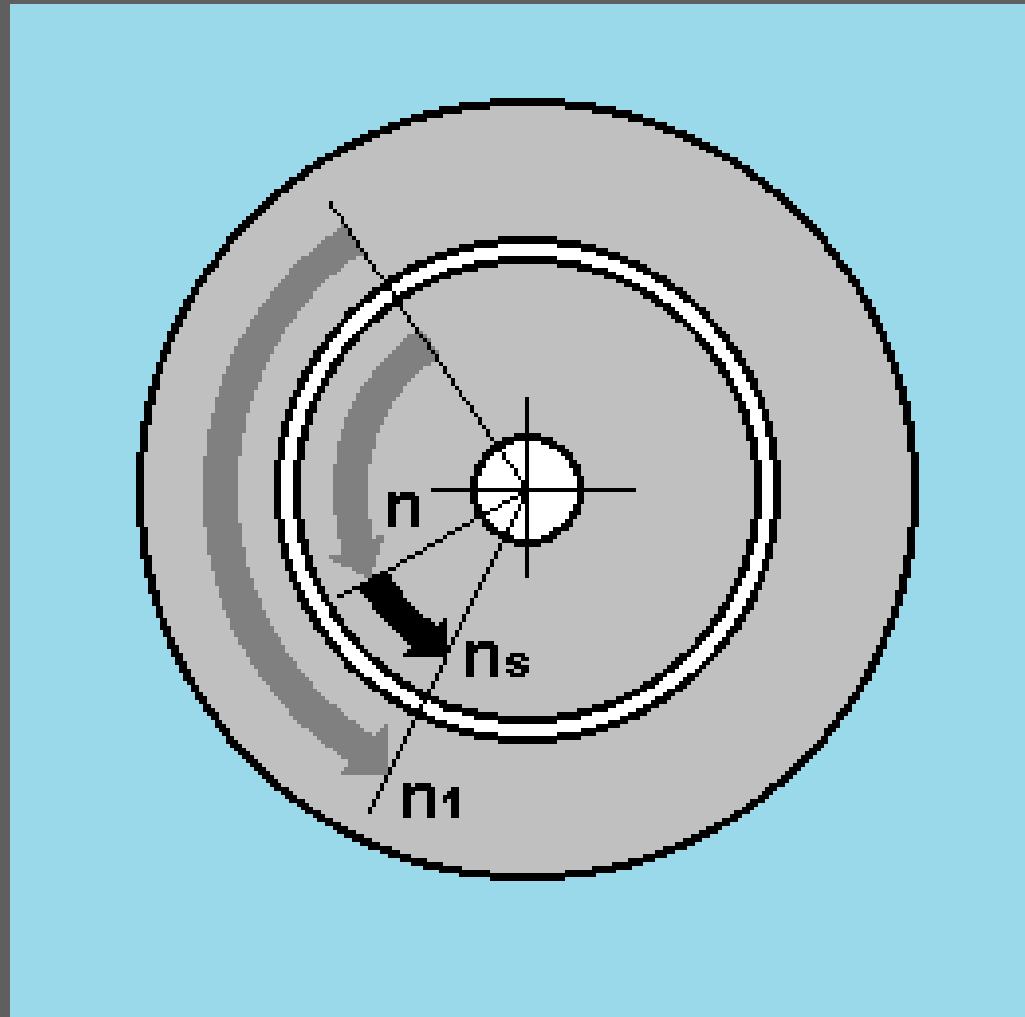
Convención para representar la corriente



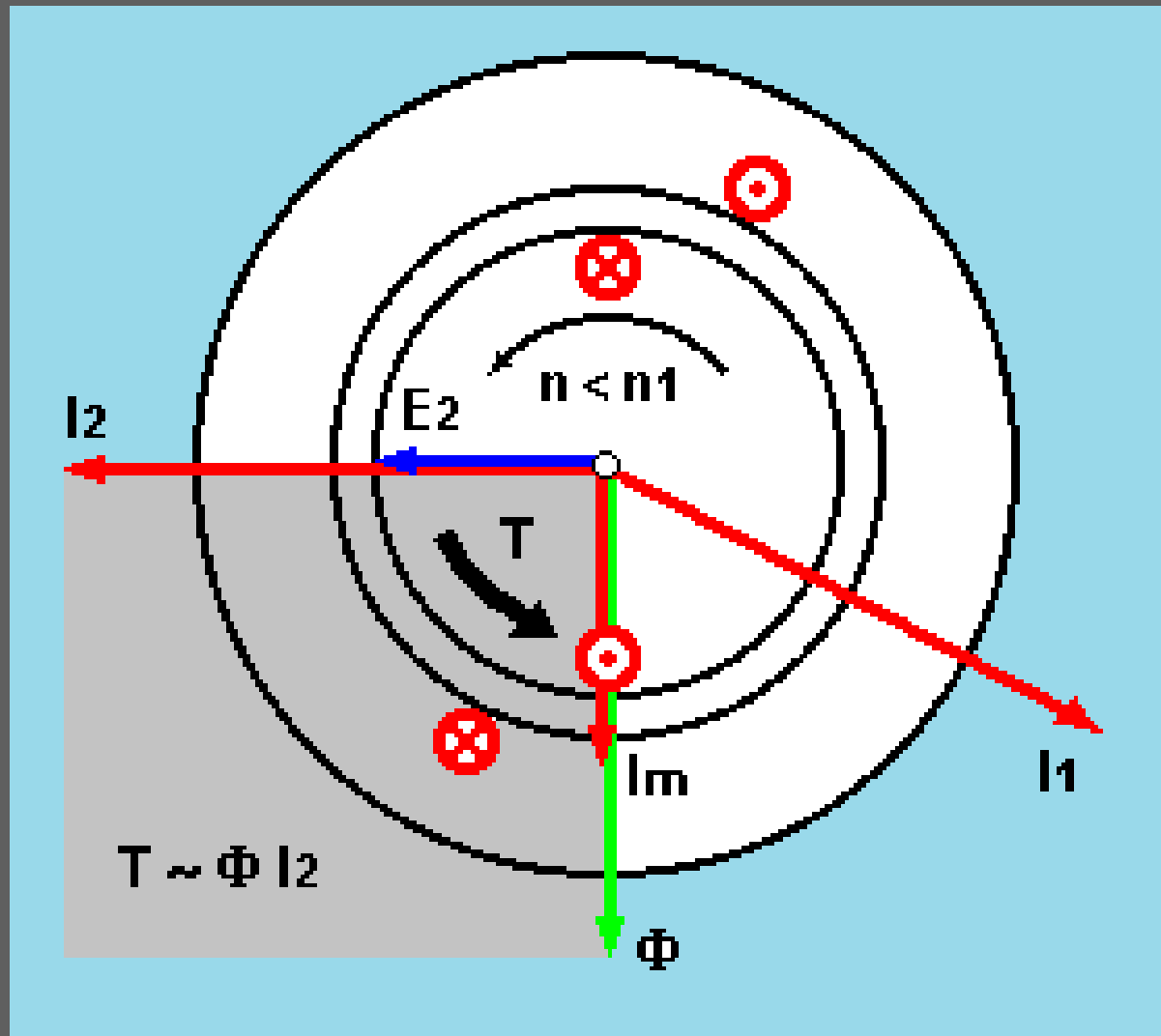
Funcionamiento en vacío



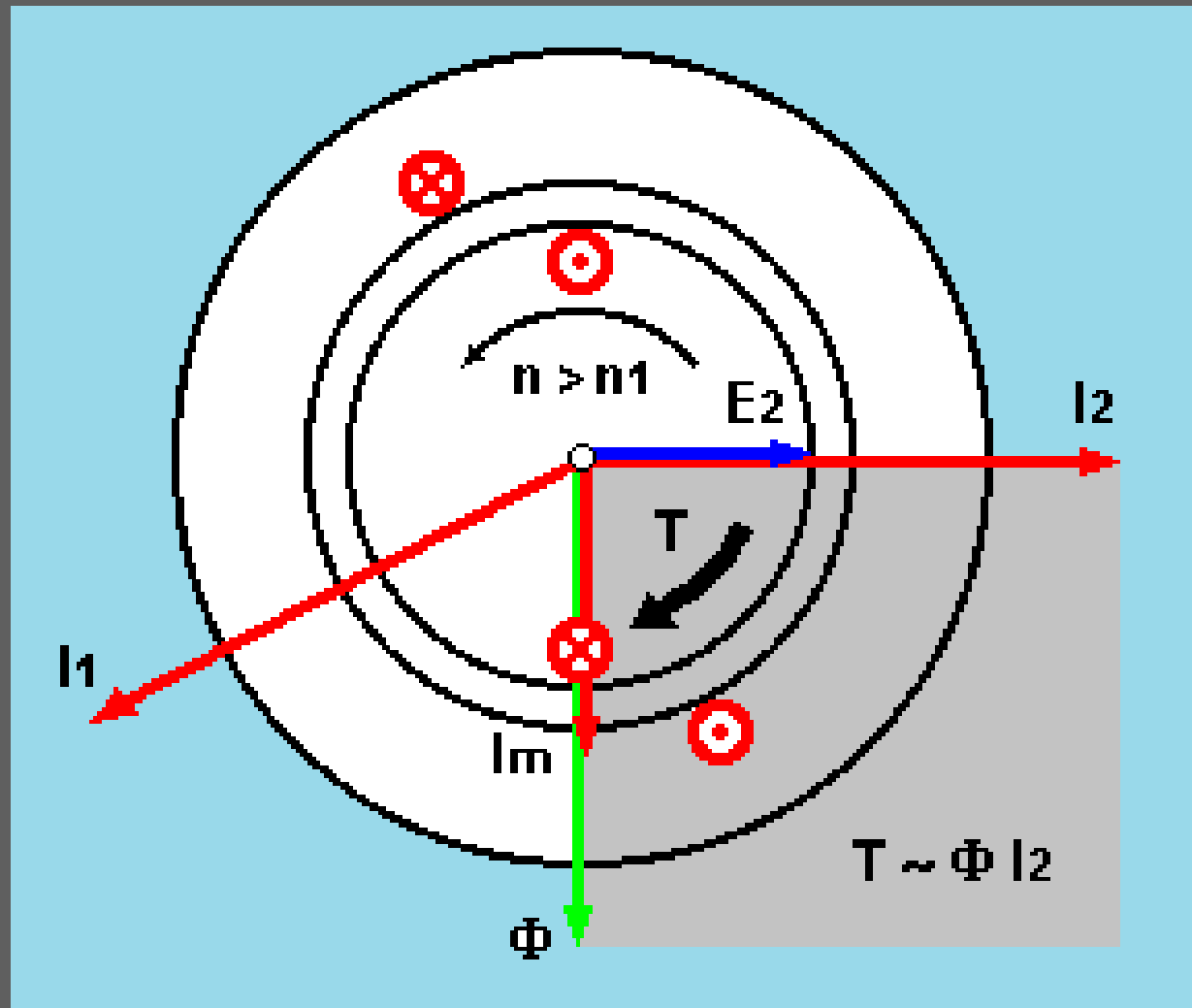
Curva de par T en función de la velocidad n



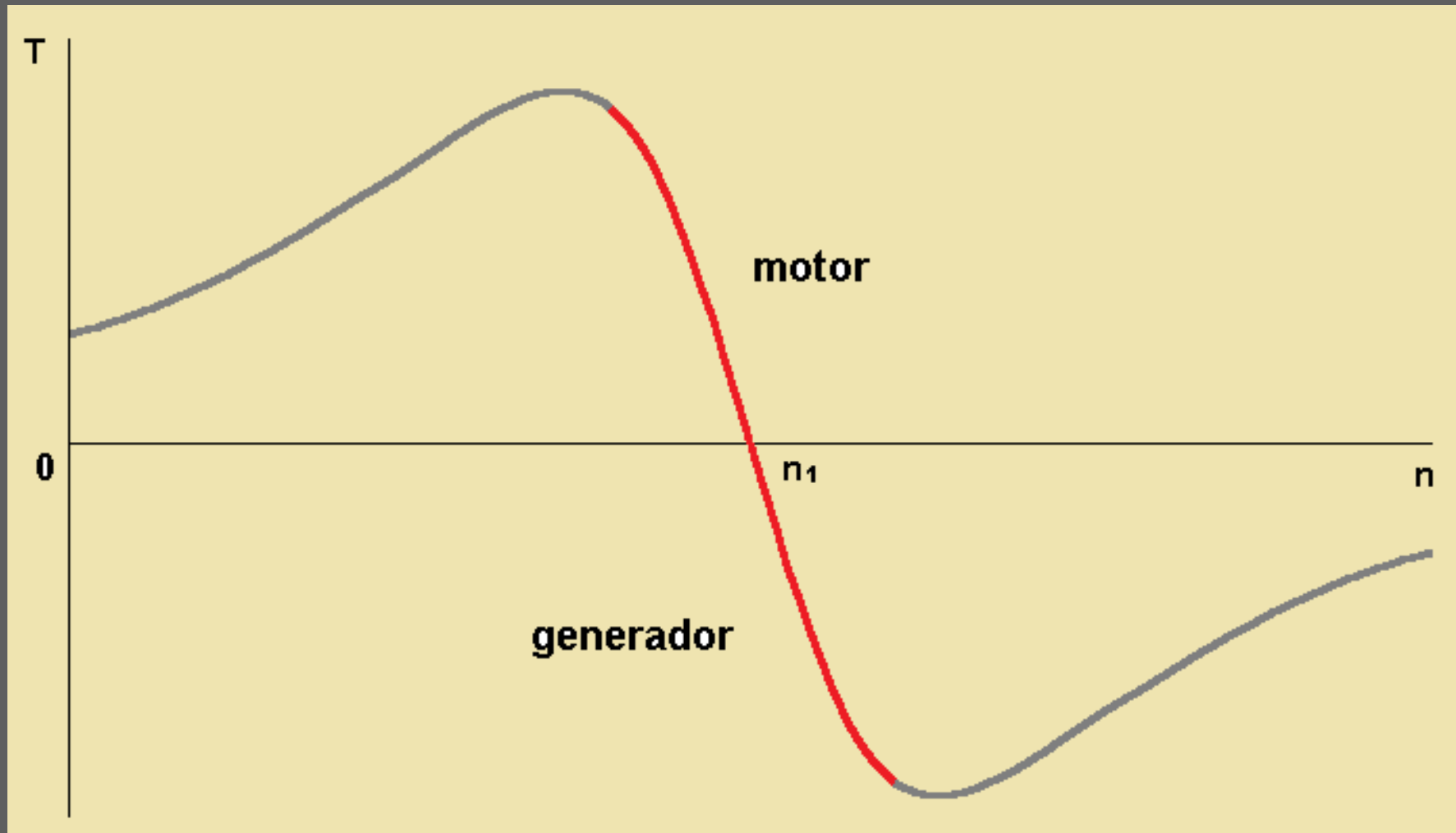
Deslizamiento $s = \frac{n_1 - n}{n_1} 100$ [%]



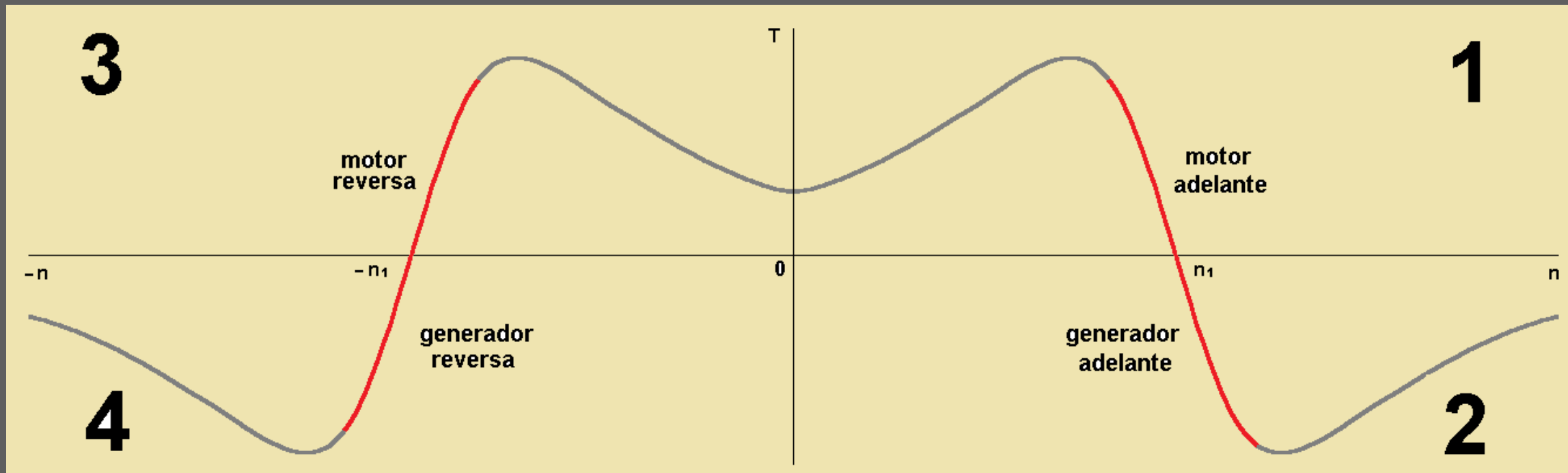
Funcionamiento como motor



Funcionamiento como generador



Funcionamiento como motor y como generador

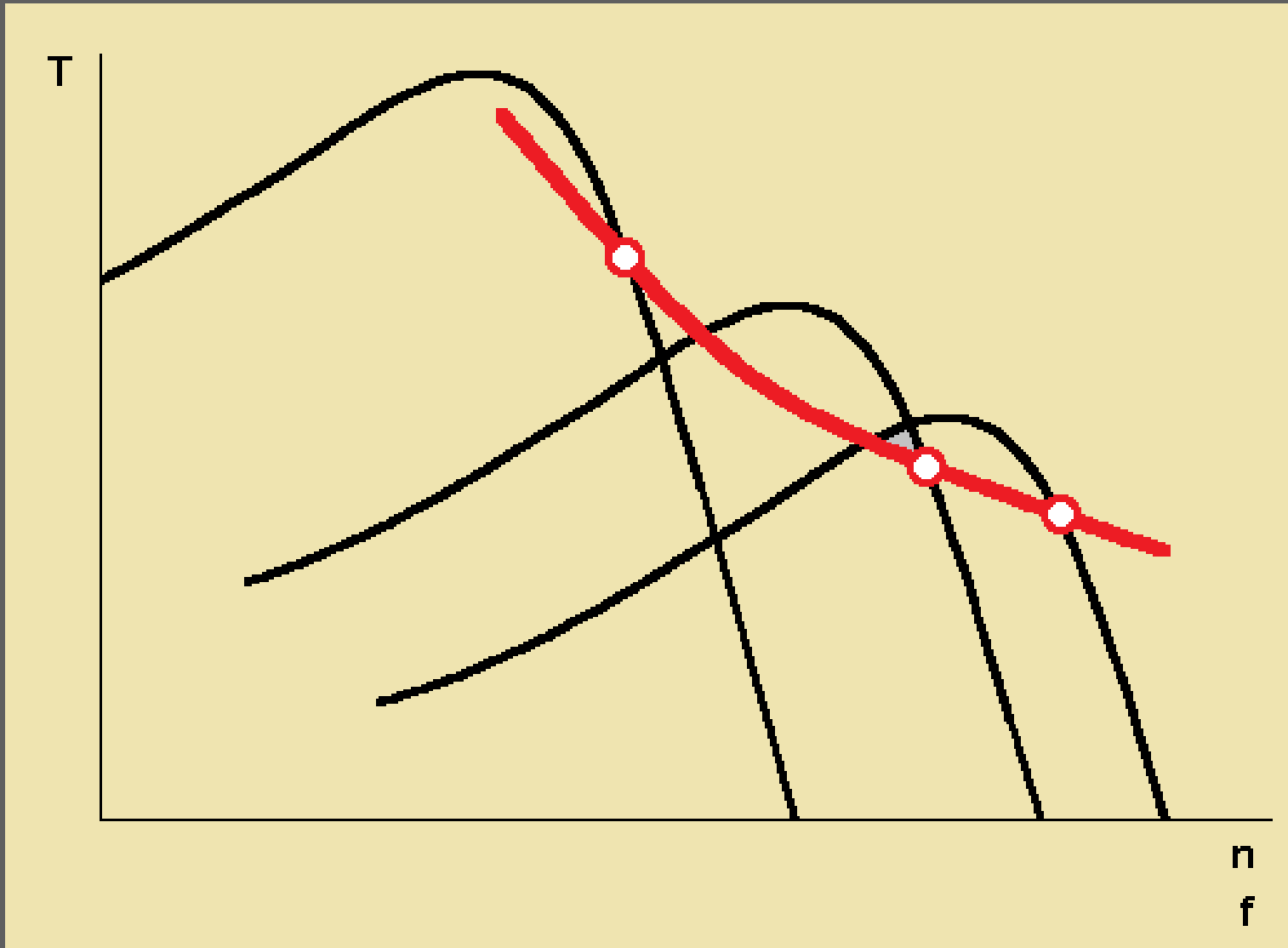


Funcionamiento en los cuatro cuadrantes

Tensión aplicada al estator:

$$V \sim F f$$

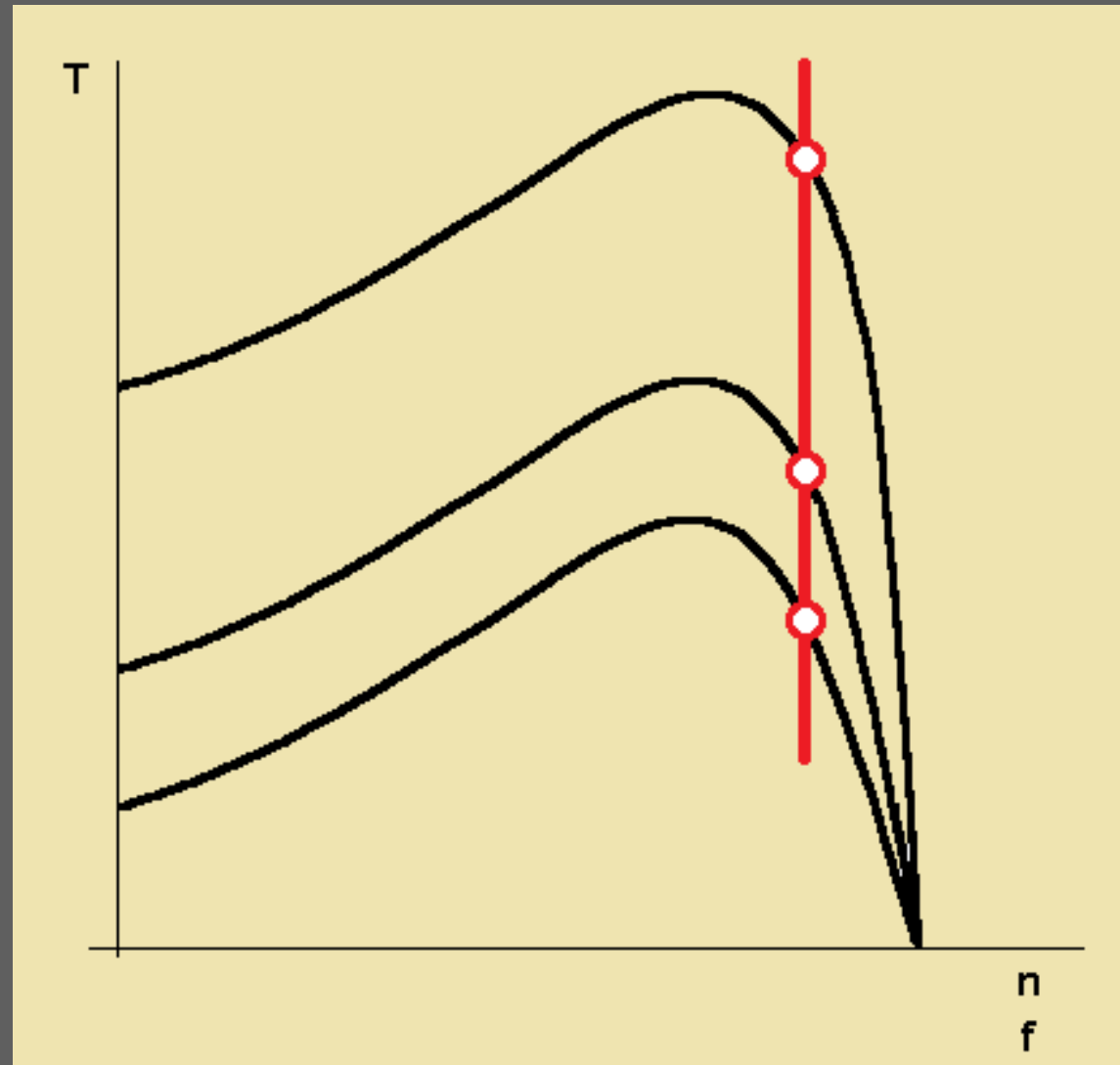
$$p \quad F \sim V/f$$



Frecuencia variable: variable frequency VF

$$F \sim V/f$$

Si f- $\text{\textcircled{R}}$ F⁻ p T⁻

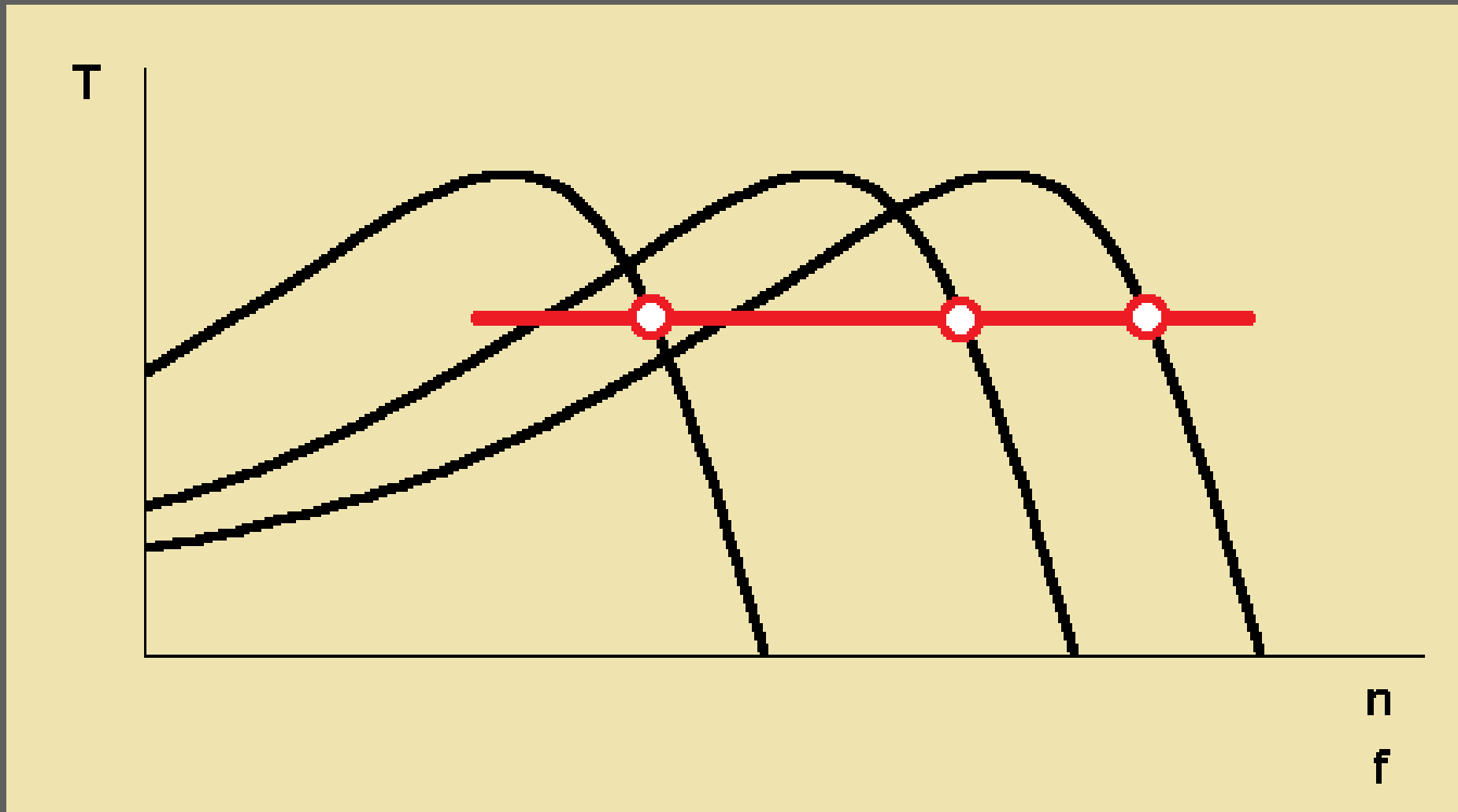


Tensión variable: variable voltage VV

Tensión aplicada al estator:

$$V \sim F f$$

$$\text{Si } V \propto F \cdot \tau$$



Tensión y frecuencia variables: VVVF

$$S_i \quad V/f = \text{cte}$$

$$F \sim V/f = \text{cte}$$

$$p \quad T = \text{cte}$$