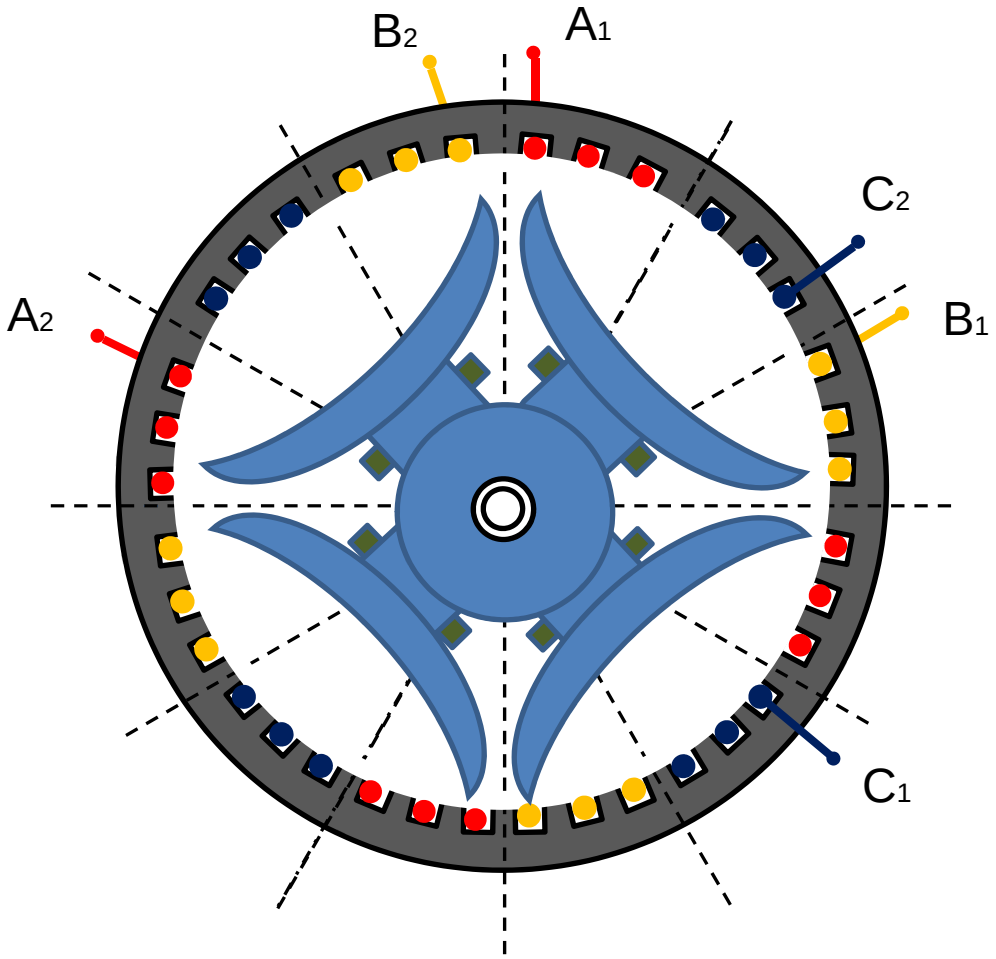


$$E_{phase} = 4.44 k_w \Phi f N_{phase}$$

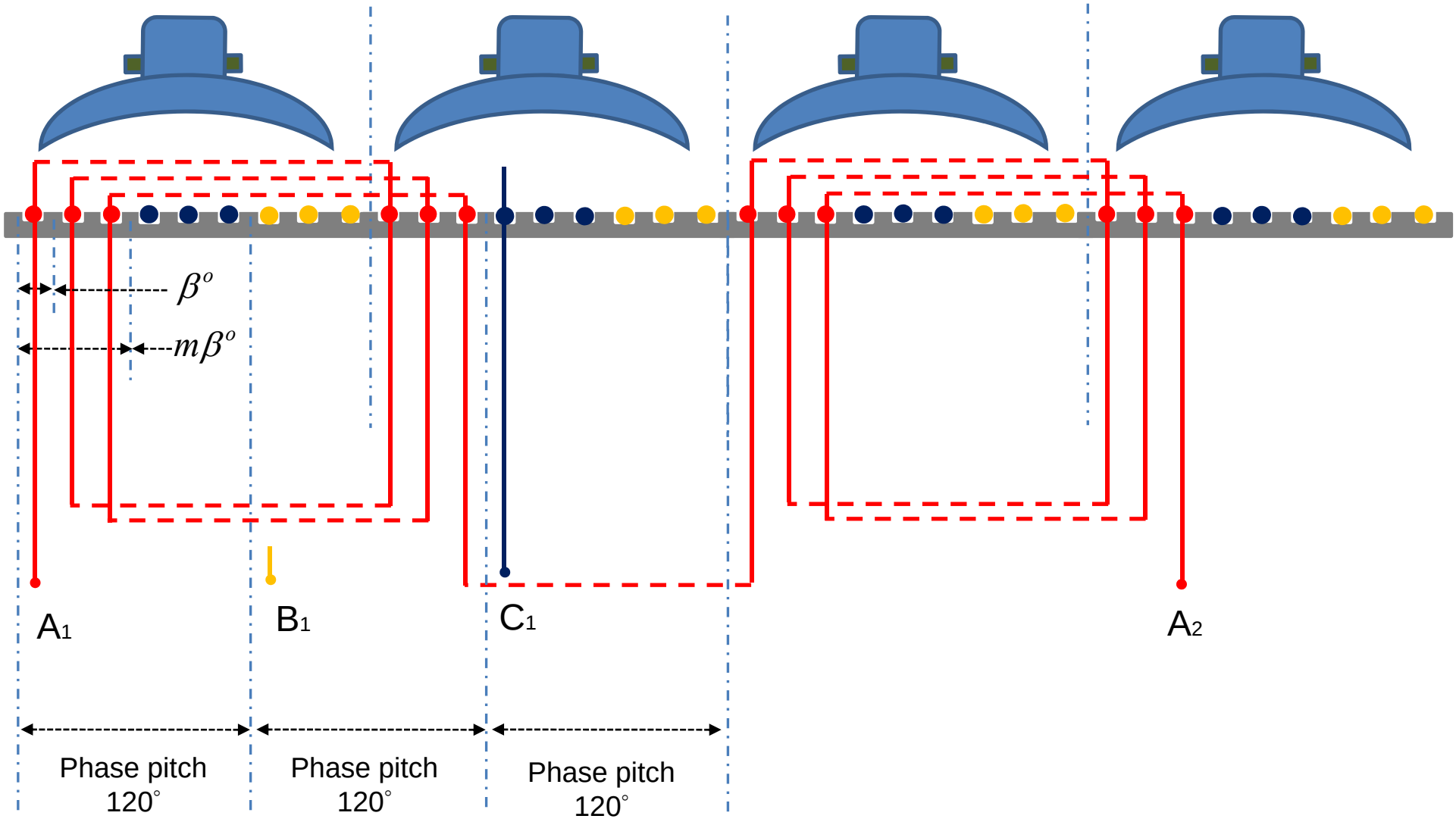
$$k_w = winding\ \ factor = k_C \times k_d$$

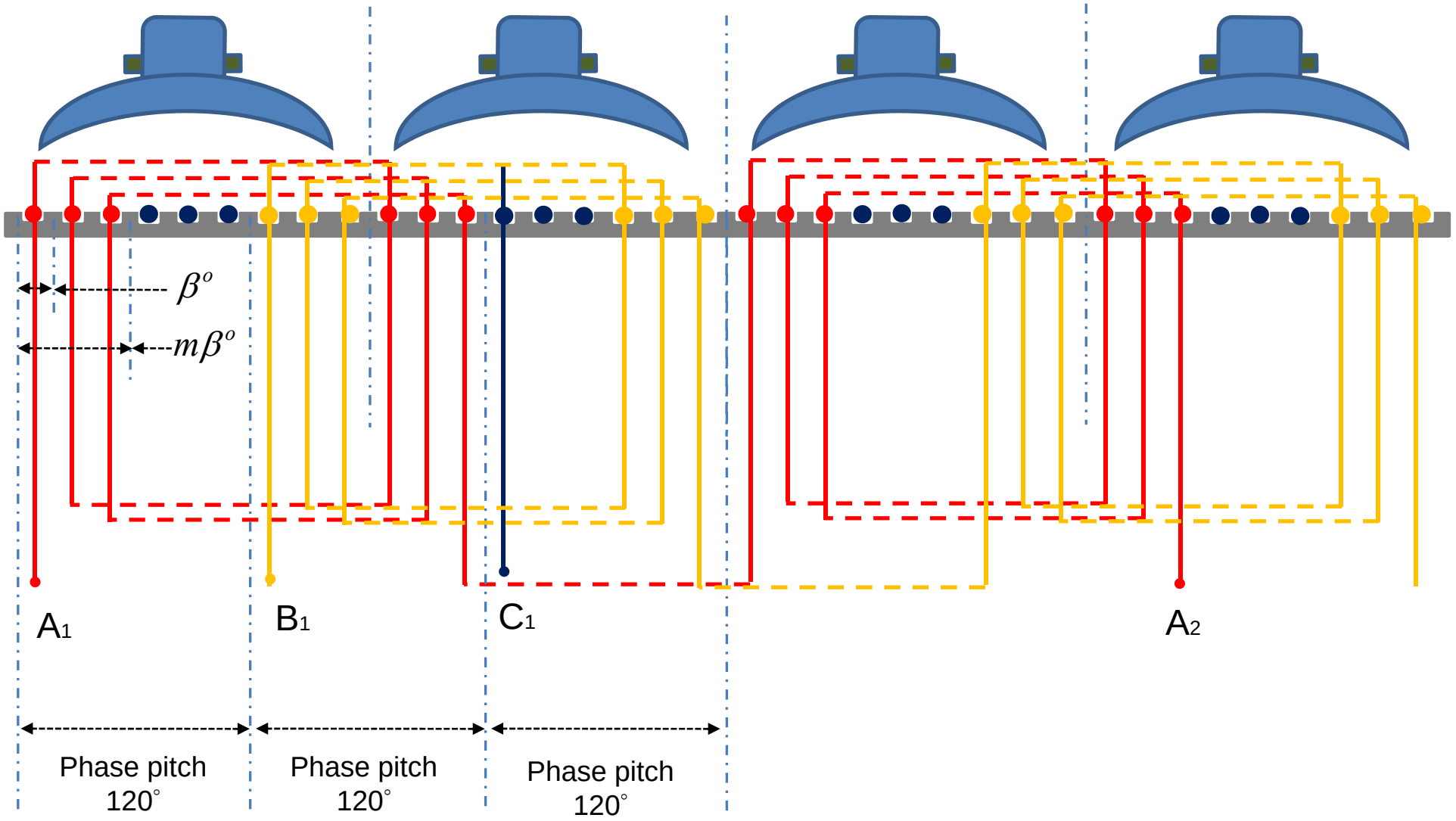
$$k_C = chording\ \ factor$$

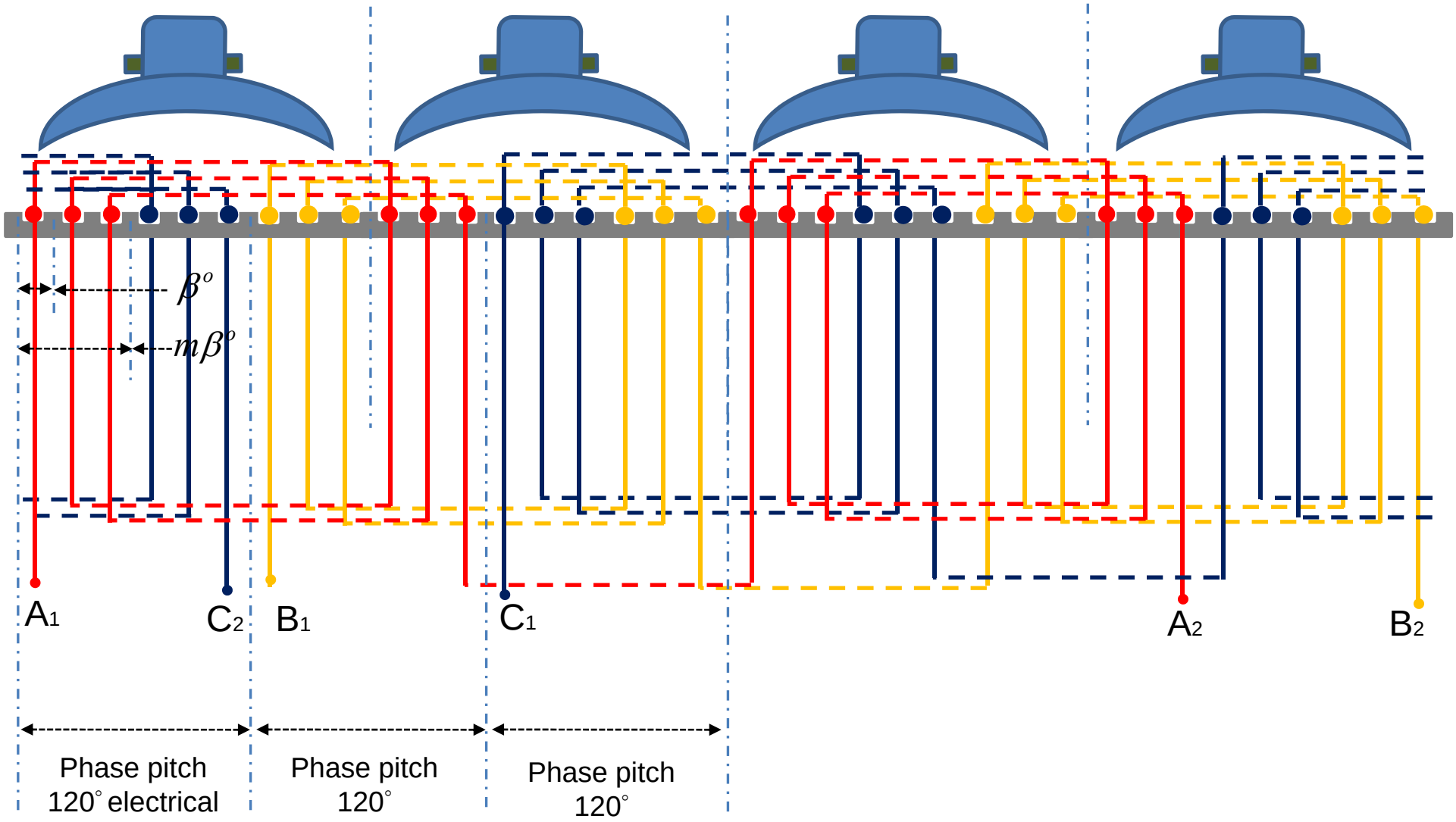
$$k_d = distribution\ \ factor$$

Just for clarifying the basic concepts of EMF factors, the following are assumed:

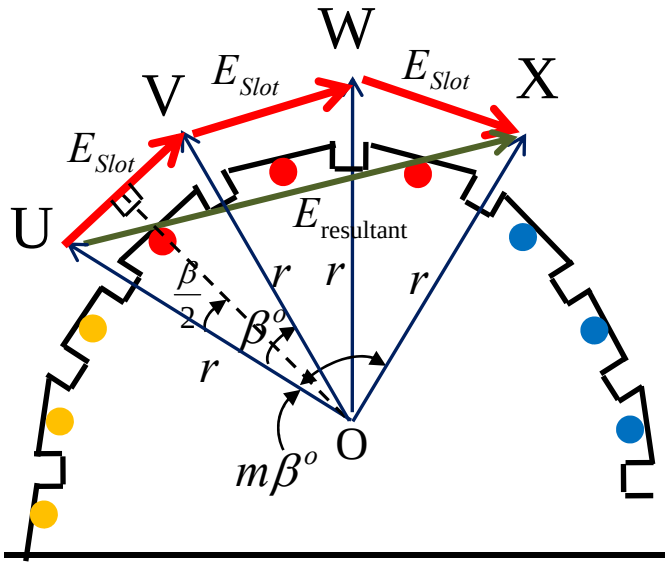
- A fully pitched winding
- Single conductor per coil-side per slot
- Number of poles = 4
- Number of slots = 36


β^o
$m\beta^o$
A1
B1
C1
A2
Phase pitch
120°
Phase pitch
120°
Phase pitch
120°


β^o
$m\beta^o$
A1
B1
C1
A2
Phase pitch
120°
Phase pitch
120°
Phase pitch
120°


β^o
$m\beta^o$
A1
C2
B1
C1
A2
B2
Phase pitch
120˚ electrical
Phase pitch
120˚
Phase pitch
120˚

Distribution Factor :



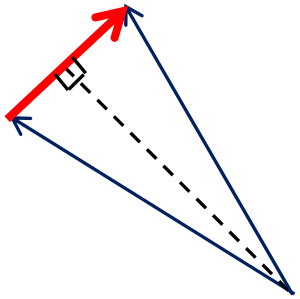
$$n = \frac{Slots}{Pole}$$

$$\beta = \frac{180^0}{Slots / Pole} = \frac{180^0}{n}$$

$$m = Slots / Pole / Phase$$

$$\therefore Phase\ spread\ angle = m\beta$$

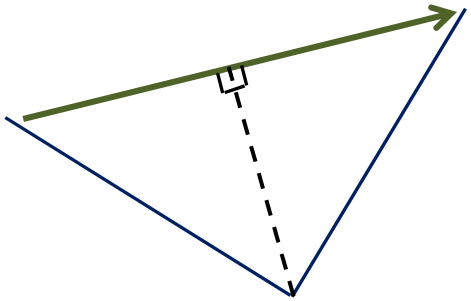
$$\Delta OUV: \quad \sin\frac{\beta}{2} = \frac{E_{Slot}/2}{r} \quad \Rightarrow \quad E_{Slot} = 2r.\sin\frac{\beta}{2}$$

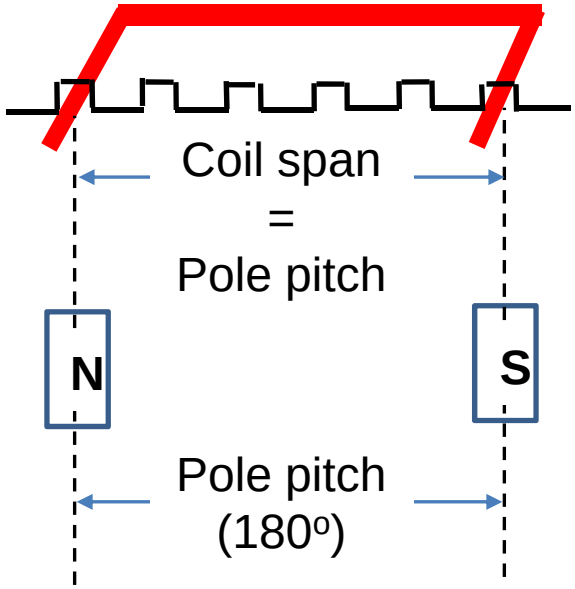


$$\text{Algebraic sum of EMFs} = \sum E_{Slot} = m \times E_{Slot} = 2mr.\sin\frac{\beta}{2}$$

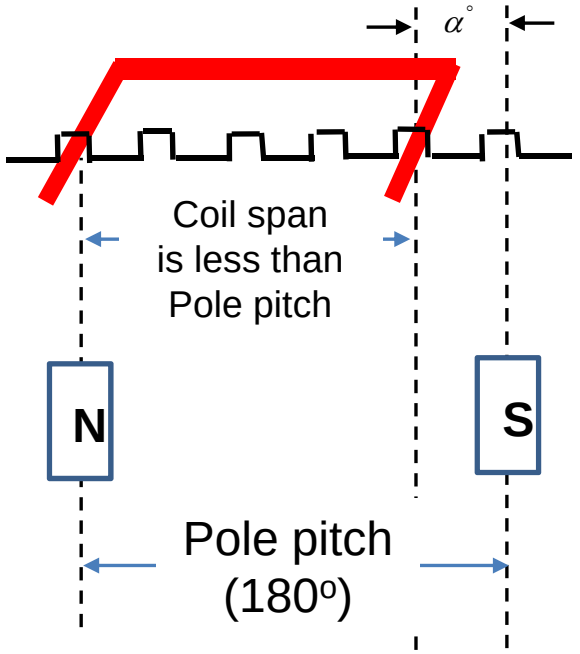
$$\Delta OUX: \quad \sin\frac{m\beta}{2} = \frac{E_{\text{resultant}}/2}{r} \quad \Rightarrow \quad E_{\text{resultant}} = 2r.\sin\frac{m\beta}{2} = \text{Vectorial sum of EMFs}$$

$$Distribution\ Factor\ K_d = \frac{\text{Vectorial sum}}{\text{Algebraic sum}} = \frac{2r.\sin\frac{m\beta}{2}}{2mr.\sin\frac{\beta}{2}} = \frac{\sin\frac{m\beta}{2}}{m.\sin\frac{\beta}{2}}$$

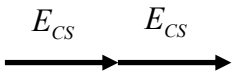




Fully pitched winding



Fractionally pitched winding (Chorded)



$$\text{Algebraic sum of EMFs} = \sum E_{CoilSide} = 2E_{CS}$$

$$\alpha^\circ = \frac{PolePitch - CoilSpan}{PolePitch} \times 180^\circ$$

$$\text{Vectorial sum of EMFs} = E_{resultant} = 2E_{CS}\cos\frac{\alpha}{2}$$

$$\text{Pitch or chording factor } K_C = \frac{\text{Vectorial sum}}{\text{Algebraic sum}} = \cos\frac{\alpha}{2}$$

Effect of chording on harmonics:

Cording factor for the nth harmonic $K_{Cn} = \cos\frac{n\alpha}{2}$

The nth harmonic is thus decreased when compared with the fundamental. (the later is the desired output voltage wave form).