

$$\text{MEr} := 9 \quad \text{MCo} := 5 \quad \lambda := 10$$

$$E(\alpha, \phi, B) := \text{MEr} \cdot \text{MCo} \cdot \lambda \cdot \cos(\alpha) - (B \cdot \text{MEr} \cdot \sin(\alpha + \phi)) - B \cdot \text{MCo} \cdot \sin(\phi)$$

Given

$$\frac{\partial}{\partial \alpha} E(\alpha, \phi, B) = 0 \quad \frac{\partial}{\partial \phi} E(\alpha, \phi, B) = 0$$

$$0 < \alpha < \pi \quad -\frac{\pi}{2} < \phi < \frac{\pi}{2}$$

$$\text{Angles1}(B, \alpha, \phi) := \text{Find}(\alpha, \phi)$$

Given

$$0 < \alpha < \pi \quad -\frac{\pi}{2} < \phi < \frac{\pi}{2}$$

$$\text{Angles2}(B, \alpha, \phi) := \text{Minimize}(E, \alpha, \phi)$$

$$\text{Angles1}(7, 1, 1) = \begin{pmatrix} 2.13 \times 10^{-8} \\ 1.571 \end{pmatrix} \quad \text{Angles2}(7, 1, 1) = \begin{pmatrix} 3.142 \\ -1.571 \end{pmatrix}$$

$$E\left(2.13 \times 10^{-8}, \frac{\pi}{2}, 7\right) = 352 \quad E\left(\pi, \frac{\pi}{2}, 7\right) = -422$$

Solutions also may be dependent on the guess values (first 2 args) for the angles.

$$\text{Angles1}(7, 0, 0) = \begin{pmatrix} 0 \\ -1.571 \end{pmatrix} \quad \text{Angles1}(7, 1, 1) = \begin{pmatrix} 2.13 \times 10^{-8} \\ 1.571 \end{pmatrix} \quad \text{Angles1}(7, 2, 2) = \begin{pmatrix} 3.142 \\ 1.571 \end{pmatrix}$$

$$\text{Angles2}(7, 0, 0) = \begin{pmatrix} 1 \times 10^{-6} \\ 1.571 \end{pmatrix} \quad \text{Angles2}(7, 1, 1) = \begin{pmatrix} 3.142 \\ -1.571 \end{pmatrix} \quad \text{Angles2}(7, 2, 2) = \begin{pmatrix} 3.142 \\ -1.571 \end{pmatrix}$$

$$\text{Angles1}\left(7, \pi, \frac{\pi}{2}\right) = \begin{pmatrix} 3.142 \\ 1.571 \end{pmatrix} \quad \text{Angles1}\left(28, \pi, \frac{\pi}{2}\right) = \begin{pmatrix} 3.142 \\ 1.571 \end{pmatrix} \quad \text{Angles1}(28, 0, 0) = \begin{pmatrix} 0 \\ -1.571 \end{pmatrix}$$

$$\text{Angles2}\left(27, \pi, \frac{\pi}{2}\right) = \begin{pmatrix} 3.142 \\ -1.571 \end{pmatrix} \quad \text{Angles2}\left(28, \pi, \frac{\pi}{2}\right) = \begin{pmatrix} 3.142 \\ -1.571 \end{pmatrix} \quad \text{Angles2}(28, 0, 0) = \begin{pmatrix} 1 \times 10^{-6} \\ 1.571 \end{pmatrix}$$

$$E\left(0, \frac{\pi}{2}, 28\right) = 58$$

$$E\left(\pi, \frac{\pi}{2}, 28\right) = -338$$

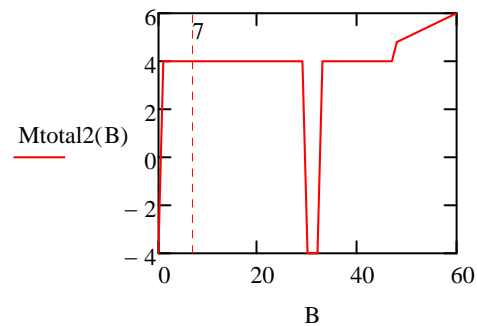
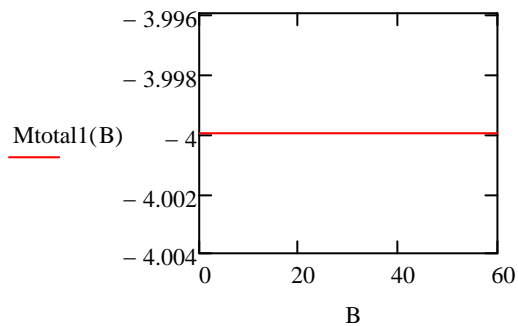
The guess values are hardcoded in the routines below. You may chose to change them and you will see the effect this has on Mtotal.
 You may also chose to calculate appropriate guess values in those routines dependent on the value of B, if that seems appropriate.

Guess values: $\alpha_g := \pi$ $\phi_g := \frac{\pi}{2}$

$$M_{total1}(B) := \begin{cases} \begin{pmatrix} \alpha \\ \phi \end{pmatrix} \leftarrow \text{Angles1}(B, \alpha_g, \phi_g) \\ M_{Er} \cdot \sin(\alpha + \phi) + M_{Co} \cdot \sin(\phi) \end{cases}$$

$$M_{total2}(B) := \begin{cases} \begin{pmatrix} \alpha \\ \phi \end{pmatrix} \leftarrow \text{Angles2}(B, \alpha_g, \phi_g) \\ M_{Er} \cdot \sin(\alpha + \phi) + M_{Co} \cdot \sin(\phi) \end{cases}$$

B := 0 .. 60



I don't think that either of the two is what you expected.

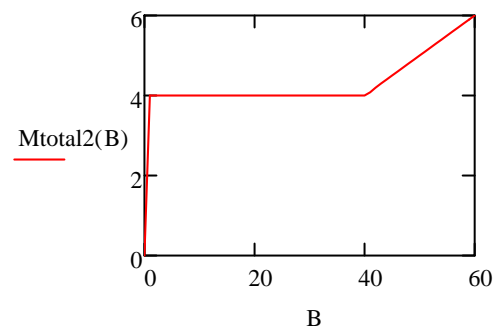
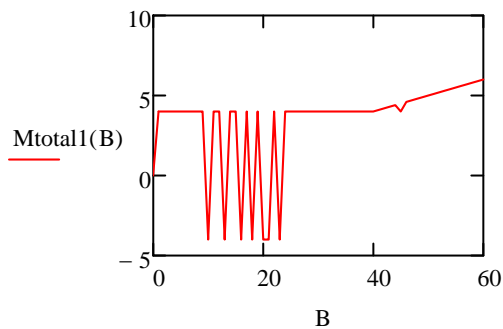
Here the same with different guess values

Guess values: $\alpha_g := \frac{\pi}{2}$ $\phi_g := 0$

$$M_{total1}(B) := \begin{cases} \begin{pmatrix} \alpha \\ \phi \end{pmatrix} \leftarrow \text{Angles1}(B, \alpha_g, \phi_g) \\ M_{Er} \cdot \sin(\alpha + \phi) + M_{Co} \cdot \sin(\phi) \end{cases}$$

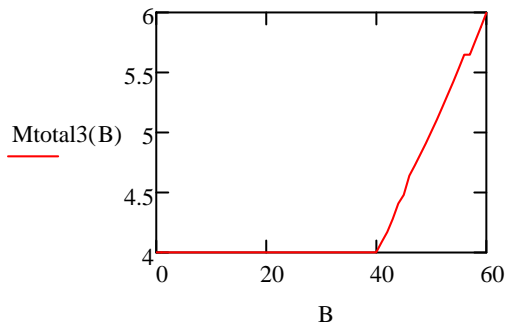
$$M_{total2}(B) := \begin{cases} \begin{pmatrix} \alpha \\ \phi \end{pmatrix} \leftarrow \text{Angles2}(B, \alpha_g, \phi_g) \\ M_{Er} \cdot \sin(\alpha + \phi) + M_{Co} \cdot \sin(\phi) \end{cases}$$

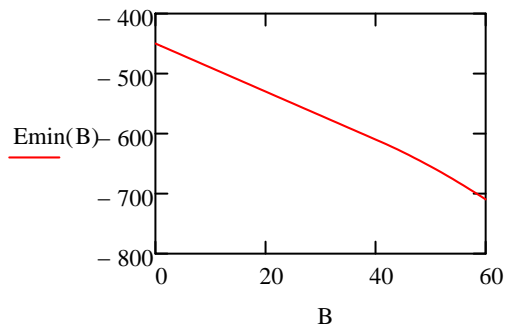
B := 0 .. 60



grid := 125

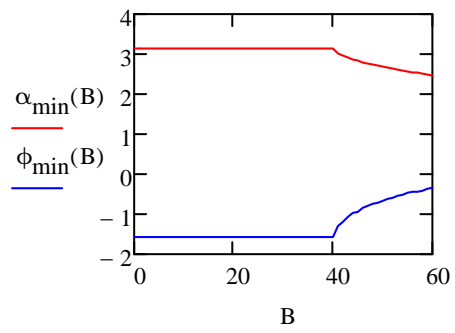
$$\text{Angles3}(B) := \left| \begin{array}{l} \min \leftarrow \infty \\ \left(\begin{array}{l} \alpha_{\min} \\ \phi_{\min} \end{array} \right) \leftarrow \left(\begin{array}{l} \text{NaN} \\ \text{NaN} \end{array} \right) \\ \text{for } a \in 0, \frac{\pi}{\text{grid}} .. \pi \\ \quad \text{for } f \in \frac{-\pi}{2}, \frac{-\pi}{2} + \frac{\pi}{\text{grid}} .. \frac{\pi}{2} \\ \quad \quad \left| \begin{array}{l} e \leftarrow E(a, f, B) \\ \text{if } e < \min \\ \quad \left| \begin{array}{l} \left(\begin{array}{l} \alpha_{\min} \\ \phi_{\min} \end{array} \right) \leftarrow \left(\begin{array}{l} a \\ f \end{array} \right) \\ \min \leftarrow e \end{array} \right. \end{array} \right. \\ \text{return } \left(\begin{array}{l} \alpha_{\min} \\ \phi_{\min} \end{array} \right) \end{array} \right.$$

$$\text{Mtotal3}(B) := \left(\begin{array}{l} \alpha \\ \phi \end{array} \right) \leftarrow \text{Angles3}(B) \\ \left| \text{MEr} \cdot \sin(\alpha + \phi) + \text{MCo} \cdot \sin(\phi) \right.$$


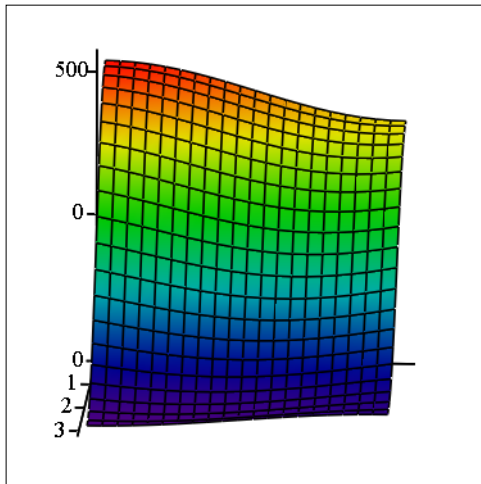
$$\text{Emin}(B) := \left(\begin{array}{l} \alpha \\ \phi \end{array} \right) \leftarrow \text{Angles3}(B) \\ \left| E(\alpha, \phi, B) \right.$$


$$\alpha_{\min}(\mathbf{B}) := \text{Angles3}(\mathbf{B})_0$$

$$\phi_{\min}(\mathbf{B}) := \text{Angles3}(\mathbf{B})_1$$

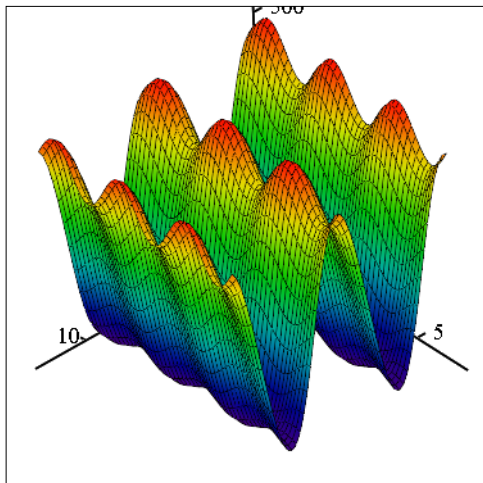


$$f(\alpha, \phi) := E(\alpha, \phi, 7)$$



f

Here is the surface for $B=7$ for the range of the angles you gave in your range variables. Minimum obviously in the bottom left corner for $\alpha=\pi$ and $\phi=\pi/2$



f

Here is the same surface for a wider range of the angles.