$$\therefore \ u_1 = \frac{1}{\sqrt{MR^2}} \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$$

Similarly, using $\quad A u_2 = \lambda_2 M u_2$

$$2a_2 - b_2 = (2+\sqrt{2})\, a_2 \Rightarrow \quad b_2 = -\sqrt{2}\, a_2$$

$$-a_2 + 2b_2 - c_2 = (2+\sqrt{2})\, b_2 \Rightarrow c_2 = a_2$$

$$-b_2 + 2c_2 = (2+\sqrt{2})\, c_2 \Rightarrow c_2 = a_2$$

$$u_2 = \begin{pmatrix} a_2 \\ -\sqrt{2}\, a_2 \\ a_2 \end{pmatrix}$$

Normalization $\quad (u_2, M u_2) = 1 \quad$ gives

$$I \,(a_2, -\sqrt{2}\, a_2, a_2) \begin{pmatrix} a_2 \\ -\sqrt{2}\, a_2 \\ a_2 \end{pmatrix} = 1$$

ie $\quad a_2^2 I + 2a_2^2 I + a_2^2 I = 4a_2^2 I = 1$

$$\therefore \ a_2 = \frac{1}{2\sqrt{I}} = \frac{1}{\sqrt{2MR^2}}$$

$$u_2 = \frac{1}{\sqrt{2MR^2}} \begin{pmatrix} 1 \\ -\sqrt{2} \\ 1 \end{pmatrix}$$

Similarly for u_3, we have

$$2a_3 - b_3 = (2-\sqrt{2})\, a_3 \Rightarrow b_3 = \sqrt{2}\, a_3$$

$$-a_3 + 2b_3 - c_3 = (2-\sqrt{2})\, b_3 \Rightarrow a_3 = c_3$$

$$-b_3 + 2c_3 = (2-\sqrt{2})\, c_3 \Rightarrow a_3 = c_3$$