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the mathematical model for one metronome results:

$$m\left(l\ddot{\theta} + g\sin\theta + \cos\theta\,\ddot{x}\right) + ml\,\epsilon\left(\left(\frac{\theta}{\theta_0}\right)^2 - 1\right)\dot{\theta} = 0$$

for the eq^{s} for 4 metronomes

$$m\left(l_1\ddot{\theta}_1 + g\sin\theta_1 + \cos\theta_1\,\ddot{x}\right) + ml_1\,\epsilon\left(\left(\frac{\theta_1}{\theta_{1,0}}\right)^2 - 1\right)\dot{\theta}_1 = 0$$

$$m\left(l_2\ddot{\theta}_2 + g\sin\theta_2 + \cos\theta_2\,\ddot{x}\right) + ml_2\,\epsilon\left(\left(\frac{\theta_2}{\theta_{2,0}}\right)^2 - 1\right)\dot{\theta}_2 = 0$$

$$m\left(l_3\ddot{\theta}_3 + g\sin\theta_3 + \cos\theta_3\,\ddot{x}\right) + ml_3\,\epsilon\left(\left(\frac{\theta_3}{\theta_{3,0}}\right)^2 - 1\right)\dot{\theta}_3 = 0$$

$$m\left(l_4\ddot{\theta}_4 + g\sin\theta_4 + \cos\theta_4\,\ddot{x}\right) + ml_4\,\epsilon\left(\left(\frac{\theta}{\theta_{3,0}}\right)^2 - 1\right)\dot{\theta}_4 = 0$$

$$\ddot{x}\left[M + 4m\right] + \sum_{i}^{4} ml_i\left(\cos\theta_i\,\ddot{\theta}_i - \sin\theta_i\,\dot{\theta}^2\right) = 2$$

$$M(q)\ddot{q} + C(q,\dot{q})\dot{q} + G(q) = \tilde{2}$$

$$M(q) = \begin{bmatrix} I_1 & 0 & 0 & 0 & ml_1\cos\theta_1 \\ 0 & I_2 & 0 & 0 & ml_2\cos\theta_2 \\ & 0 & I_3 & 0 & ml_3\cos\theta_3 \\ 0 & 0 & 0 & I_4 & ml_4\cos\theta_4 \\ ml_1\cos\theta_1 & ml_2\cos\theta_2 & ml_3\cos\theta_3 & ml_4\cos\theta_4 & M + 4m \end{bmatrix}$$

$$S_i = \epsilon\left(\left(\frac{\theta_i}{\theta_{i,0}}\right)^2 - 1\right) m_i\, l_i^2$$

$$R_i = m_i\dot{\theta}_i l_i \sin\theta_i$$

$$C = \begin{bmatrix} S_1 & 0 & 0 & 0 & 0 \\ 0 & S_2 & 0 & 0 & 0 \\ 0 & 0 & S_3 & 0 & 0 \\ 0 & 0 & 0 & S_4 & 0 \\ R_1 & R_2 & R_3 & R_4 & 0 \end{bmatrix}$$

$$G = \begin{bmatrix} mgl_1\sin\theta_1 \\ mgl_2\sin\theta_2 \\ mgl_3\sin\theta_3 \\ mgl_4\sin\theta_4 \\ 0 \end{bmatrix}$$