Equation (19) of the article https://link.springer.com/article/10.1007/s11071-020-06010-w

$$\mathbf{J}\cdot\omega+\left(\sum_{i=1}^{n} m_i\mathbf{r}_i\times(\omega\times\mathbf{r}_i)\right)\cdot\omega+M\mu\mathbf{r}\times(\omega\times\mathbf{r}+\dot{\mathbf{r}})=0.$$

Using the «BAC − CAB» rule

$$\mathbf{r}\times(\omega\times\mathbf{r})=\langle\mathbf{r},\mathbf{r}\rangle\omega-\langle\mathbf{r},\omega\rangle\mathbf{r}=|\mathbf{r}|^2\omega-\mathbf{r}\otimes\mathbf{r}\cdot\omega=(|\mathbf{r}|^2\mathbf{I}_3-\mathbf{r}\otimes\mathbf{r})\cdot\omega,$$

we can get the following linear system

$$\left[\mathbf{J}+\left(\sum_{i=1}^{n} m_i|\mathbf{r}_i|^2\right)\mathbf{I}_3-\sum_{i=1}^{n} m_i\cdot\mathbf{r}_i\otimes\mathbf{r}_i+M\mu|\mathbf{r}|^2\mathbf{I}_3-M\mu\cdot\mathbf{r}\otimes\mathbf{r}\right]\omega=-M\mu\cdot\mathbf{r}\times\dot{\mathbf{r}}.$$

This is a linear version of the basic equation which allows to find the angular velocity vector from the known parameters of the mechanical system. This version is used in the fiction-mass.py.