$$with(LinearAlgebra):$$
$$with(VectorCalculus):$$

$$M := Matrix([[\cos(\theta_1), \cos(\theta_2), \cos(\theta_3)], [\sin(\theta_1), \sin(\theta_2), \sin(\theta_3)], [1.2\cdot\sin(\theta_1) - 3.1\cdot\cos(\theta_1), -1\cdot\sin(\theta_2) - 3.6\cdot\cos(\theta_2), -1.5\cdot\sin(\theta_3) + 3.4\cdot\cos(\theta_3)]])$$

$$M := \begin{bmatrix} \cos(\theta_1) & \cos(\theta_2) & \cos(\theta_3) \\ \sin(\theta_1) & \sin(\theta_2) & \sin(\theta_3) \\ 1.2\sin(\theta_1) - 3.1\cos(\theta_1) & -\sin(\theta_2) - 3.6\cos(\theta_2) & -1.5\sin(\theta_3) + 3.4\cos(\theta_3) \end{bmatrix}$$

$$DM := Determinant(M)$$

$$DM := -0.5\cos(\theta_1)\sin(\theta_2)\sin(\theta_3) + 6.5\cos(\theta_1)\cos(\theta_3)\sin(\theta_2) + 0.5\cos(\theta_1)\cos(\theta_2)\sin(\theta_3) + 2.7\sin(\theta_1)\cos(\theta_2)\sin(\theta_3) - 7.0\sin(\theta_1)\cos(\theta_2)\cos(\theta_3) - 2.2\sin(\theta_1)\cos(\theta_3)\sin(\theta_2)$$

$$sol1 := solve(DM = 0, \{\theta_1\})$$

$$sol1 := \left\{\theta_1 = \arctan\left(\frac{5.\left(\tan(\theta_3)\tan(\theta_2) - 1.\tan(\theta_3) - 13.\tan(\theta_2)\right)}{27.\tan(\theta_3) - 22.\tan(\theta_2) - 70.}\right)\right\}$$

$$sol2 := solve(DM = 0, \{\theta_2\})$$

$$sol2 := \left\{\theta_2 = \arctan\left(\frac{5.\cos(\theta_1)\tan(\theta_3) + 27.\sin(\theta_1)\tan(\theta_3) - 70.\sin(\theta_1)}{5.\cos(\theta_1)\tan(\theta_3) - 65.\cos(\theta_1) + 22.\sin(\theta_1)}\right)\right\}$$

$$sol3 := solve(DM = 0, \{\theta_3\})$$

$$sol3 := \left\{\theta_3 = \arctan\left(\frac{65.\cos(\theta_1)\sin(\theta_2) - 22.\sin(\theta_2)\sin(\theta_1) - 70.\cos(\theta_2)\sin(\theta_1)}{5.\cos(\theta_1)\sin(\theta_2) - 5.\cos(\theta_1)\cos(\theta_2) - 27.\cos(\theta_2)\sin(\theta_1)}\right)\right\}$$

3 conditions for the directions of the three thrusters that would not make it possible to generate an arbitrary moment and force along a line through the origin.