Home_Work

计算物理作业

研究在势**函数中添加微**扰项对二维**偕振子**运动轨**迹的影**响

1. 理论分析

势函数:

$$V(x,y) = a(x^2 + y^2) + e_1 x^3 + e_2 x^3 + e_3 x^3 y^3$$
 (1)

在本次讨论中 a 固定为 0.5.

x,y 方向上的受力分别为:

$$F_x = -rac{\partial V}{\partial x} = -(2ax + 3e_1x^2 + 3e_3x^2y^3)$$
 (2)

$$F_y = -rac{\partial V}{\partial y} = -(2ay + 3e_2y^2 + 3e_3x^3y^2)$$
 (3)

于是x, y 方向的加速度(设质点质量 m = 1):

$$\frac{d^2x}{dt^2} = \frac{F_x}{m} = -(2ax + 3e_1x^2 + 3e_3x^2y^3) \tag{4}$$

$$\frac{d^2y}{dt^2} = \frac{F_y}{m} = -(2ay + 3e_2y^2 + 3e_3x^3y^2) \tag{5}$$

初始条件:

$$x(0) = 0; \ x'(0) = 1; \ y(0) = 1; \ y'(0) = 0$$
 (6)

2. 结果展示

由(4)(5)(6)可得:

Case	Solution	Visualization
$e_1=e_2=e_3=0$	1.0 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0	y(t) 2 -2 -1 -1 -2 x(t)
$e_1=e_2=0.1, e_3=0$	1.0 0.5 1 20 1 30 1 - x(t) -0.5 1 -1.0 1 20 1 20 1 20 1 20 1 20 1 20 1 20 1	y(t) 2 -2 -1 1 2 x(t) -12 -2
$e_1=e_2=-0.1, e_3=0$	1.0 0.5 -0.5 -1.0	y(t) 2 -2 -1 1 2 x(t)
$e_1=0.1, e_2=0, e_3=0$	0.5 -0.5 -0.5 -0.5 -1.0	y(t) 2 -1 -1 -2 -1 -1 -2 -1 -2
$e_1=0.1, e_2=-0.1, e_3=0$	0.5 x(t) -0.5 y(t)	y(t) 2 -2 -1 1 2 x(t) -1 -2
$e_1=0, e_2=0, e_3=0.1$	1.5 1.0 0.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	y(t) 2 -1 -1 -2 -1 -2 -1

Case	Solution	Visualization
$e_1=0.1, e_2=0.1, e_3=0.1$	1.0 0.5 1.0 -0.5 -1.0 -1.5	y(t) 2 -2 -1 1 2 x(t)
$e_1=0.1, e_2=-0.1, e_3=0.1$	1.5 1.0 0.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	y(t) 2 -1 -1 -2 x(t)
$e_1 = -0.1, e_2 = -0.1, e_3 = 0.1$	1.5 1.0 1.0 1.0	y(t) 2 -2 -1 -1 -2 -1 -2

3. 源代码

见 programs 文件夹。