國立成功大學機械工程學系

Dynamics of Machinery

Kinematic Analysis of the Ram Drive with a Spring and a Damper

Homework 1

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Please *develop programs on a PC* and *use the package* for the kinematic analysis of the ram drive with a spring and a damper, whose skeleton is as shown in Fig. 1 and the dimensions are given in Table 1. Additionally, $r_3' = 0.17$ m, $\theta_3' = 27^\circ$, θ_1 = -107.47^o and $r_5' = 0$ m. Between links 2 and 7, there are a pair of gears, both have 22 teeth with 15 mm module and their pressure angles are 20^o, to keep $\omega_2 : \omega_7$ = 1:-1. When $\theta_2 = 0^o$, $\theta_7 = 287.45^o$ for the assembly position of the gears. Regarding the locations for the fixed pivots of the spring and damper are X_s = 0 m, Y_s = -0.75 m, and X_d =0.22 m, Y_d = 0.44 m, respectively. Please use the **analytical method** for the displacement analysis. The drive is operated with constant speeds of 10, 60, and 120 rad/sec, respectively. The results, with 1^o interval, of **displacement**, **velocity** and **acceleration** of each moving link and its **mass center** are required, furthermore the **spring length** and the **rate of change of the damper length** are also needed. Please check the results, by choosing 2 (not particular) positions, with **graphical methods**. Please investigate the relations between the input velocity and the maximum magnitudes of the velocity and acceleration, respectively, of the ram. (Hints: The derivation and programs should be able to analyze the cases with **non-zero** input acceleration, and kinematic coefficients should be gotten before the velocity and acceleration analysis.)

項目	配分	得分
結果與討論	70%	
結論與建議	10%	
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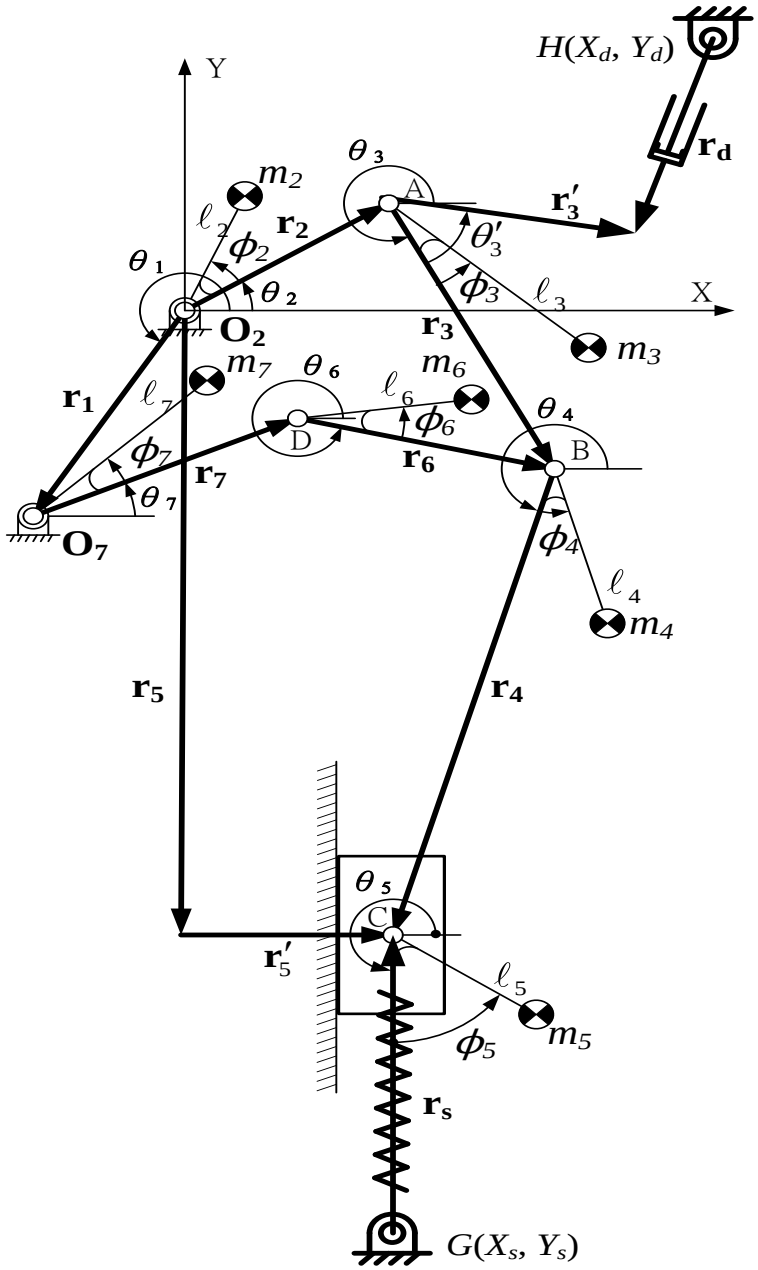

表 1 複合驅動伺服沖床之機構尺寸及幾何慣性尺寸

i	(m)	m_i (kg)	ℓ_i (m)	ϕ_i (deg)	I_i (kg×m^2)
1	0.330	---	---	---	---
2	0.055	53.00	0.0247	0	0.651
3	0.283	7.10	0.1287	13	0.047
4	0.322	10.59	0.1467	0	0.887
5	---	47.93	0.0000	0	---
6	0.165	50.03	0.0749	0	0.313
7	0.061	60.07	0.0277	0	0.955