Assigned 11-03-30, due 11-03-07

Problem Set 6

Dynamics of Mechanisms
MECH 314
Winter Term, Academic Year: 2010-2011

Problem 1: Problem 15.7 from the book J.J. Uicker, G.R. Pennock and J.E. Shigley: Theory of Machines and Mechanisms (3rd edition)

15.7. The following data apply to the four-bar linkage shown in the figure:

$R_{AO_2} = 0.3\,\text{m}, R_{O_4O_2} = 0.9\ \text{m}, R_{BA} = 1.5\ \text{m}, R_{BO_4} = 0.8\ \text{m}, R_{CA} = 0.85\,\text{m}, \theta_c = 33^\circ, R_{DO_4} = 0.4\text{m}, \theta_D = 53^\circ, R_{G_2O_2} = 0, R_{G_3A} = 0.65\,\text{m},$
$\alpha = 16^\circ, R_{G_4O_4} = 0.45\text{m}, \beta = 17^\circ, m_2 = 5.2\text{kg}, m_3 = 65.8\text{kg}, m_4 = 21.8\text{kg}, I_{G_2} = 2.3\,\text{kg.m}^2, I_{G_3} = 4.2\,\text{kg.m}^2, I_{G_4} = 0.51\,\text{kg.m}^2.$

A kinematic analysis at $\theta_2 = 53^\circ, \boldsymbol{\omega}_2 = 12\hat{\mathbf{k}}$ rad/s ccw, and $\boldsymbol{\alpha}_2 = 0$, gave $\theta_3 = 0.7^\circ, \theta_4 = 20.4^\circ, \boldsymbol{\alpha}_3 = 85.6\ \text{rad/s}^2$ cw, and $\boldsymbol{\alpha}_4 = 172\ \text{rad/s}^2$ cw, $\mathbf{A}_{G_3} = 96.4\angle 259^\circ\ \text{m/s}^2$, and $\mathbf{A}_{G_4} = 97.8\angle 270^\circ\ \text{m/s}^2$. Find all the pin reactions and the torque to be applied to link 2.

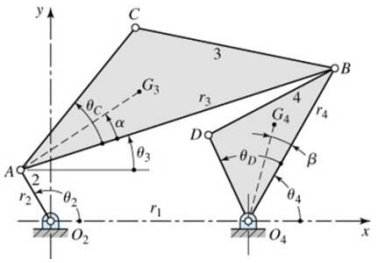

Figure P15.7

Problem 2: Problem 10.2 from the book J.J. Uicker, G.R. Pennock and J.E. Shigley: Theory of Machines and Mechanisms (3rd edition)

10.2. Part (a) of the figure gives the pitch diameters of a set of spur gears forming a train. Compute the kinematic coefficient of the train. Determine the speed and direction of rotation of gears 5 and 7.

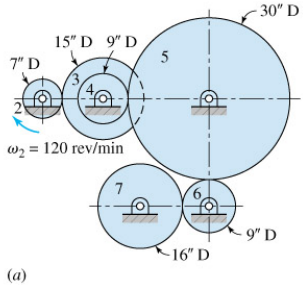

Figure P10.2

Problem 3: In the figure below, shaft C is stationary. If gear 2 rotates at 800 rev/min ccw, what are the speed and direction of rotation of shaft B?