The Fourbar Crank-Slider

The first inversion of the offset crank-slider has its slider block sliding against the ground plane as shown in Figure 7-6a. Its accelerations can be solved for in similar manner as was done for the pin-jointed fourbar.

The position equations for the fourbar offset crank-slider linkage (inversion #1) were derived in Section 4.6 (p. 191). The linkage was shown in Figures 4-9 (p. 191) and 6-21 (p. 319) and is shown again in Figure 7-6a on which we also show an input angular acceleration α_2 applied to link 2. This α_2 can be a time-varying input acceleration. The vector loop equations 4.14 are repeated here for your convenience.

$$\mathbf{R}_2 - \mathbf{R}_3 - \mathbf{R}_4 - \mathbf{R}_1 = 0 \tag{4.14a}$$

$$a e^{j\theta_2} - b e^{j\theta_3} - c e^{j\theta_4} - d e^{j\theta_1} = 0 \tag{4.14b}$$

In Section 6.7 (p. 315) we differentiated equation 4.14b with respect to time noting that a, b, c, θ_1, and θ_4 are constant but the length of link d varies with time in this inversion.

$$j a \omega_2 e^{j\theta_2} - j b \omega_3 e^{j\theta_3} - \dot{d} = 0 \tag{6.20a}$$

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The term $\dot{d}$ is the linear velocity of the slider block. Equation 6.20a is the velocity difference equation.

We now will differentiate equation 6.20a with respect to time to get an expression for acceleration in this inversion of the crank-slider mechanism.

$$\left(ja\alpha_2 e^{j\theta_2} + j^2 a\omega_2^2 e^{j\theta_2} \right) - \left(jb\alpha_3 e^{j\theta_3} + j^2 b\omega_3^2 e^{j\theta_3} \right) - \ddot{d} = 0 \tag{7.14a}$$

Simplifying:

$$\left(a\alpha_2 \, je^{j\theta_2} - a\omega_2^2 e^{j\theta_2} \right) - \left(b\alpha_3 \, je^{j\theta_3} - b\omega_3^2 \, e^{j\theta_3} \right) - \ddot{d} = 0 \tag{7.14b}$$

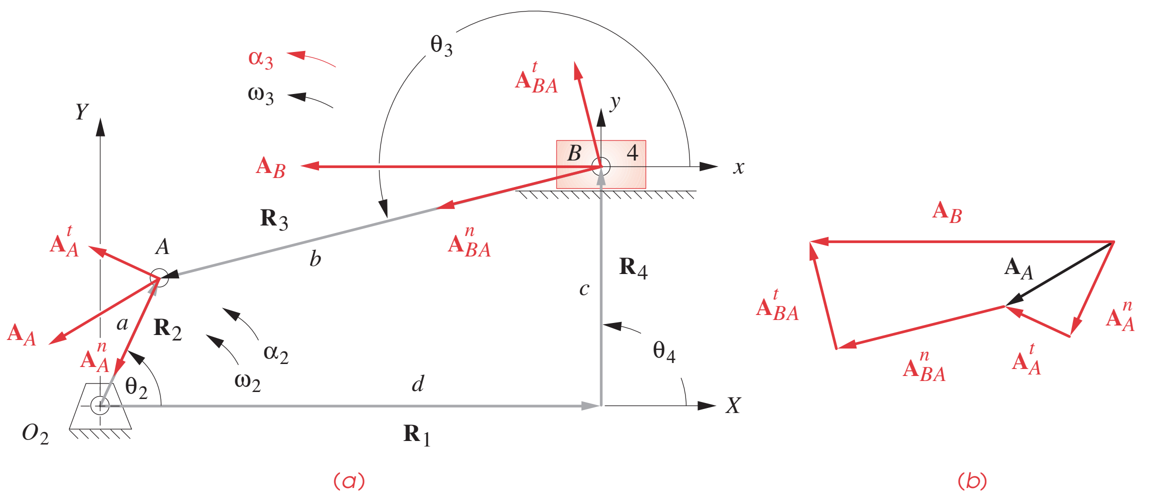

FIGURE 7-6

Position vector loop for a fourbar slider-crank linkage showing acceleration vectors