ME 5550 Intermediate Dynamics
Systems with Closed Kinematic Chains (Constraints)

The systems we have studied so far are "open chain" systems. The kinematic descriptions start at a point and advance into the system to ever more remote points. Many mechanical systems, however, have multiple points of known motion, e.g. a simple mechanism. These latter systems are said to possess "closed kinematic chains." Closed kinematic chains restrict (or constrain) the motion of the system.

Example: Consider, for example, the four-bar mechanism shown in the diagram. Using the kinematic formula for two points fixed on a rigid body, the velocity of point C may be written

\[ v_C = v_B + v_{C/B} \]
\[ = v_A + v_{B/A} + v_{C/B} \]
\[ = v_{B/A} + v_{C/B} \]

But, we also have

\[ v_C = v_D + v_{C/D} = v_{C/D} \]

So, for the mechanism to remain connected, we require that

\[ v_{C/D} = v_{B/A} + v_{C/B} \]

The same is true for the accelerations.