

## Cognates

It sometimes happens that a good solution to a linkage synthesis problem will be found that satisfies path generation constraints but which has the fixed pivots in inappropriate locations for attachment to the available ground plane or frame. In such cases, the use of a **cognate** to the linkage may be helpful. The term **cognate** was used by Hartenberg and Denavit to describe *a linkage, of different geometry, which generates the same coupler curve*. Samuel Roberts (1875) and Chebyshev (1878) independently discovered the theorem which now bears their names:

### Roberts-Chebyshev Theorem

*Three different planar, pin-jointed fourbar linkages will trace identical coupler curves.*

Hartenberg and Denavit presented extensions of this theorem to the slider-crank and the six-bar linkages:

*Two different planar slider-crank linkages will trace identical coupler curves.*

*The coupler-point curve of a planar fourbar linkage is also described by the joint of a dyad of an appropriate sixbar linkage.*

The *Cognates* pull-down menu allows switching among the three cognates which create the same coupler curve. Switching among them requires recalculation of all kinematic and dynamic parameters via the *Input*, *Dynamics*, and *Balance* buttons. The previously used mass property data is retained but can be changed easily by selecting the *Dynamics* button. The *Cayley Diagram* menu pick under *Cognates* displays that diagram of all three cognates. See Chapter 3. Whenever linkage data are changed on the *Input Screen* and recalculated, the program automatically calculates the dimensions of that linkage's two cognates. These can be switched to, calculated, and investigated at any time.