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Kevin S. Giaier
University of Dayton, stander@udayton.edu

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SERIAL CHAINS OF SPHERICAL FOUR-BAR MECHANISMS TO ACHIEVE DESIGN HELICES

Kevin S. Giaier
Advisors: Andrew Murray, Ph.D, David Myszka, Ph.D
Department of Mechanical & Aerospace Engineering

SPHERICAL FOUR-BAR MECHANISMS

Motion is defined by the angle between each joint axis. Serial chains may be formed by connecting the coupler of one four-bar to the base link of the next.

DESIGNING THE SPHERICAL JOINT

The triangular body parameters are solved for using these equations. These values are constant for all the helices.

\[ d^2 = d_j^2 + r_j^2 + h^2_j + b_j^2 + 2r_jh_j \cos(\phi_j - \theta_j) - 2J_jb_j\phi_j, \]
\[ e^2 = d_j^2 + r_j^2 - 2\cos(\phi_j) r_j h_j + h_j^2, \]
\[ k^2 = b_j^2 + 2h_j^2 - 2h_j^2 \cos(\phi_j). \]

The geometry of the joint to be copied is found with.

[\( \bar{G}_{ji} = T_j^{(i-1)} \bar{G} + \bar{K}_{j(i-1)} \),
\( \bar{n}_{ji} = T_j^{(i-1)} \bar{n} + \bar{K}_{j(i-1)}. \)]

A connecting link is designed to connect two joints. This device can now be copied infinitely to create a serial chain.

A shaft connected with universal joints can be used to actuate the device.

The helices are transformed to have the same starting base defined by the first triangular body.

Points on the design and companion helix identify the triangular body below.

Three design helices with their centers at the origin define three unique start points and targets for the mechanism.

[Image of diagrams and equations related to spherical four-bar mechanisms and helices.]