

ANALYTICAL POSITION ANALYSIS FOR RSRC MECHANISM

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Keywords: kinematics, spatial linkages, ball joint, Hartenberg - Denavit notations, analytical solutions

Abstract: The aim of the paper is obtaining the analytical relations for position analysis of spatial RSRC mechanism. The method is based on the homogenous operators method proposed by Hartenberg and Denavit, considering the specifications due to McCarthy. Subsequent to the obtained analytical relations, the graphs of the position parameters dependences from the kinematical joints of the mechanism are presented for an explicit case. The position kinematics parameters from mechanism's joints are found by means of closure matrix equation of the mechanism, as it follows:

- ζ, η, ξ for spherical pair;

- θ_3 for revolute pair;

- s, θ_4 for cylindrical pair,

as functions of constructive parameters L, d_0, r, s_0, α and of revolute angle θ_1 of the crank. The following relations were obtained:

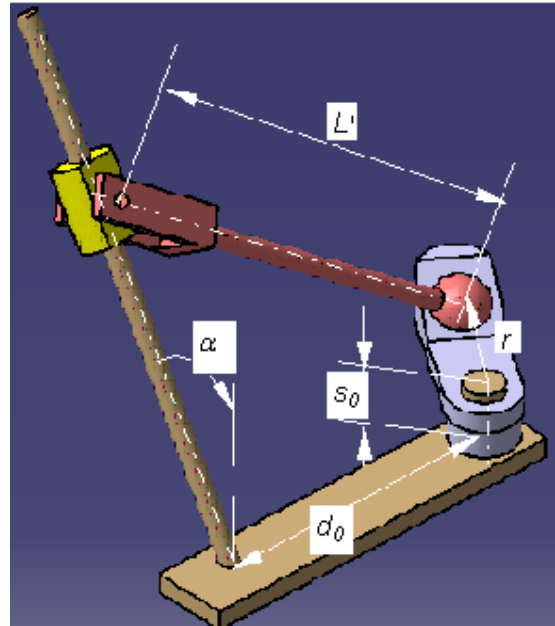


Fig. 1. RSRC Mechanism

$$s = -(s_0 \cos \alpha + r \sin \alpha \sin \theta_1) \pm \sqrt{(s_0 \cos \alpha + r \sin \alpha \sin \theta_1)^2 - 2rd_0 \cos \theta_1 - s_0^2 - d_0^2 - r^2 + L^2}$$

$$\theta_3 = -\text{asin}[(s + s_0 \cos \alpha + r \sin \alpha \cos \theta_1) / L]$$

$$\theta_4 = \text{atan2}[-(r \cos \theta_1 + d_0) / L \cos \theta_3, (r \cos \alpha \sin \theta_1 - s_0 \sin \alpha) / L \cos \theta_3]$$

$$\eta = -\text{asin}[\sin \alpha \cos \theta_3 \sin \theta_4 + \cos \alpha \sin \theta_3]$$

$$\zeta = \text{atan2} \left[\begin{array}{l} (\cos \theta_1 \cos \theta_3 \cos \theta_4 - \cos \alpha \sin \theta_1 \cos \theta_3 \sin \theta_4 + \sin \alpha \sin \theta_1 \sin \theta_3) / \cos \eta, \\ (-\sin \theta_1 \cos \theta_3 \cos \theta_4 - \cos \alpha \cos \theta_1 \cos \theta_3 \sin \theta_4 + \sin \alpha \cos \theta_1 \sin \theta_3) / \cos \eta \end{array} \right]$$

$$\xi = \text{atan2}[(-\sin \alpha \cos \theta_4) / \cos \eta, (\sin \alpha \sin \theta_3 \sin \theta_4 - \cos \alpha \cos \theta_3) / \cos \eta]$$

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