

Comments on “Architectural singularities of a class of pentapods”

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In the respective publication [1] architecturally singular designs (Ma and Angeles [10]¹) of pentapods (5-degree-of-freedom fully-parallel manipulator with an axial spindle as moving platform) with coplanar base attachments are investigated. The authors correctly identified (cf. Section 1 of [1]) pentapods, which are special 5-SPU platforms, as rigid subassemblies in Stewart Gough (SG) platforms (cf. Kong and Gosselin [3]). Therefore, architecturally singular pentapods can only be degenerated SG manipulators (cf. Karger [19]).

Based on the scientific background of singularity analysis of parallel manipulators of SG type some comments about the article [1] from the perspective of previous results reported in the literature seem appropriate.

It is correct that the two conditions given in [18] are not sufficient for a manipulator to be architecturally singular, but due to the phrasing in Section 1 of [1], the reader may believe that the two algebraic conditions are always the same in the publications [18,19,20]. But this is not the case. In fact, it can easily be checked that the two algebraic conditions given in Eq. (17) of the final work [20] of Karger on this topic are sufficient. Therefore, the problem of determining all architecturally singular pentapods was already solved in [20]. An architecturally singular pentapod can only be of type 3,4,5,6,7,8 or 10 of Theorem 3 of [20], as for the types 1,2,9 and the two degenerated planar cases 11 and 12 (cf. [2]) all six pairs of anchor points have to fulfill certain geometric conditions.

Moreover, by considering a pentapod as a subassembly in a SG platform, the characterization of architecture singularity by the rank defectiveness of $\hat{\mathbf{T}}$ (cf. Section 3.1 of [1]) follows directly from the more general one given by Röschel and Mick in Remark 1 of [3] for planar architecturally singular manipulators.

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¹ The underlined references refer to the list of publications given in [1].

A similar characterization for the non-planar case was given by the author in [4].

Finally, the author wants to express his appreciation for the novel geometric interpretation of the generic case and for the resulting index (cf. Eq. (17) of [1]), which evaluates the proximity to an architecturally singular design.

References

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