FORWARD KINEMATICS OF PARALLEL MANIPULATORS WITH 6 AND 5 ACTUATORS

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We consider a SPMp of Gough – Stewart type (Fig. 1a), where the mobile platform *p* is the hexagonal plate $B_1B_2B_3B_4B_5B_6$ which is connected to the fixed hexagonal platform $O_1O_2O_3O_4O_5O_6$ by six pneumatic actuators (legs) of SCS type. Each actuator, which is a SCS (spherical + cylindrical + spherical) kinematical chain, consists of two elements (bars) *1* and *2* having in the tips O_i and B_i as spherical semi-pairs (S). The other tips of links 1 and 2 are connected by a actuated cylindrical joint A_i (piston-cylinder) (Fig. 1b).

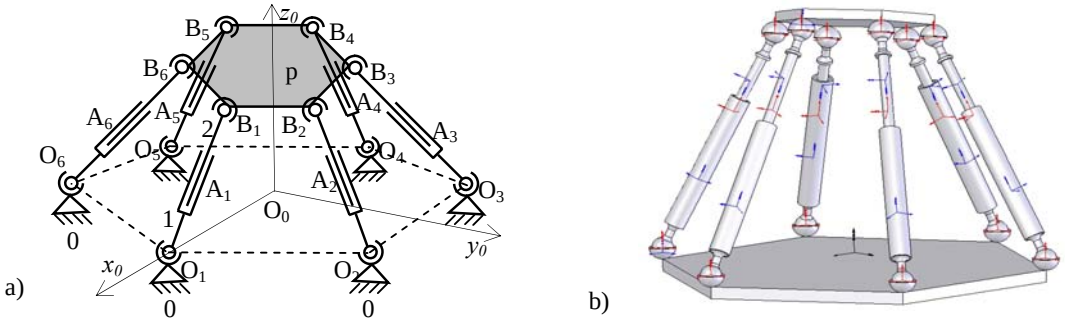

Fig. 1. Kinematic schema and design of Gough – Stewart SPMp with six actuators, SCS type.

Another SPMp with six turned (rotate) actuators (equivalent to Gough-Stuart platform) is accomplished by means of the kinematical chains $A_iB_iC_i$ (*i=1,2,...,*6), RSS type (Fig. 2a). Each of these chains consists of two bars (1 and 2). SPMp with five actuators $A_iB_iC_i$ (*i=1,2,...,5*), RSS type (Fig. 2b) have a central kinematical chain O_0BP, RRS type.

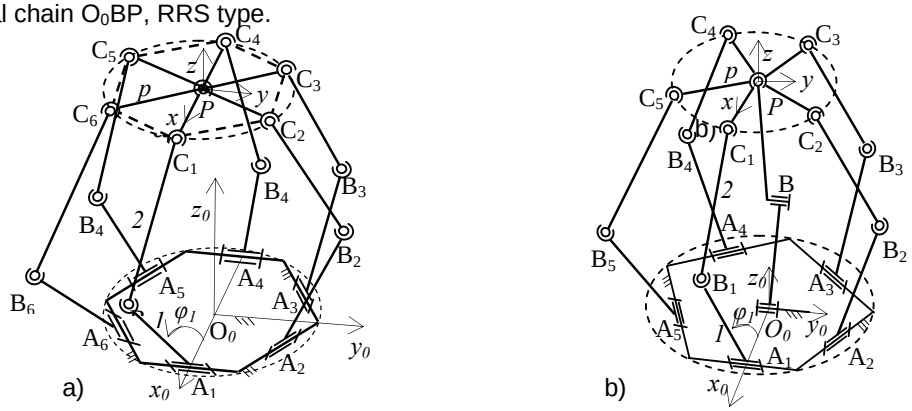

Fig. 2. Kinematic schema of SPMp with six (a) and five (b) actuators, RSS type

The mobility of kinematical structures presented (fig. 1, 2) is analytical calculated by formula [1]:

$$Mb = \sum_{m=1}^{5} mC_m - \sum_{r=2}^{6} rN_r$$

The equation systems with 18 and 15 unknown parameters are solved by means of Mathematica software. In that case the analytical solution is not possible, but a numerical solution for particular cases can be found.

Selected references

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