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CONCEPTUAL DESIGN OF A MOBILE PARALLEL SYMMETRY ROBOT FOR IN SPACE ASSEMBLY

Abstract

There are a lot of advanced future exploration, science and commercial mission applications that could benefit significantly from large-span and large-area structural systems, which is beyond the limitation of any current or proposed launch vehicles and should be assembly in space through by several times of launches. To assembly these large, light-weight, high stiffness and precise space structure, a Mobile Parallel Symmetry Assembling Robot (MPSAR) is introduced, which is composed of two mirror symmetry static / moving platforms (platform A and B), symmetry 1-RRRRR and 2-SPS chains between platform A and B, and end effectors. MPSAR has superior characteristics of high precision and stiffness jigging ability compared to traditional series mechanism in space, and high efficient mobility generated by its symmetry structure. While platform A connecting to the assembled structure behaves as the static form, platform B can spread out to grasp, transfer, and assembly a new module as moving platform, then platform B connecting to the new assembled module behaves as the static platform and platform A disconnect to assembly the next module as moving platform. Above process can be redone and platform A and B serve as static, moving platform alternatively till all modules are assembled. The kinematics equation with analytical form of the 2-SPS+1-RRRRR mechanism is established, and the inverse position solution has been gotten. A digital model of MPSAR with end effectors and guiding cameras is created and optimized, which allows high precision module assembling and efficient moving to the next assembling position.