

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Moon Exploration – Part 1 (2A)

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SYNTHESIS OF PARALLEL STRUCTURE MOON ROVER

**Abstract**

Moon researches are increasingly attracting the scientific society. For example, Harbin Institute of Technology in China researched series of rovers with eight, six and four wheels by using open serial, or closed parallelogram kinematic chains. The latest lunar rover Yutu-2 made the first landing on the far side of the Moon with volumetric parameters 1,5\*1,0\*1,0 m and weight 140 kgs. It is equipped with two suspensions with open kinematic chains and six wheels. The balancing platform accommodates necessary antennas, cameras, georadar analyzers and other equipment.

Basic requirements for rovers among others are: lightweight, compact for transportation and simple mechanism with high DoF for rough terrain conditions.

This research proposes synthesis of 4-,6- and 8-wheeled rovers with parallel kinematic structures. Path generating slider-rocker mechanism is used with parameters  $BA = AP = AO$ , where  $BA$  and  $AP$  are colinear and form an input coupler link. Seven-link path generating part of suspension mechanism, includes two guiding couplers, which describe straight lines. Linkages considered above present a new bogie. This suspension mechanism also includes a rocker (rigidly connected to it kinematic chain with a wheel). The rovers have two symmetrical suspensions, which are interconnected by differential mechanism. That makes possible to reduce inclination of the carrier platform, when the wheels of opposite side overcome obstacles, while maintaining the parallelism of platform.

Using new formulae for independent loops, DoF and the motion of the moving platform, the problems of structural synthesis of parallel 4-,6- and 8-wheeled rovers were solved. The purpose of kinematic synthesis was to determine the values of the lengths of basic links. Using the decomposition approach and the method of the best approximation for the function (Chebyshev method), the parameters of the bogies were determined.

On the basis of the considered approach, the problems of synthesis of 4,6 and 8 wheeled Moon rovers were solved.