RECONSTRUCTION SYNTHESIS OF THE LOST SUBSYSTEM FOR THE PLANETARY MOTIONS OF ANTIKYTHERA MECHANISM

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Abstract
The mechanism for the planetary motions contained in the lost subsystem of Antikythera mechanism is a strict challenge of the reconstruction design and attracts many scholars’ attentions. In the modern time, Edmunds and Morgan, and Wright successively presented the design concepts, even the solid reconstruction models. To focus on the study of lost mechanisms, this work provides a systematic procedure of the reconstruction design to synthesize all feasible designs describing the planetary motion in the lost subsystem. And all synthesized designs agree with the science and technology standards of the subject’s time period. Based on the kinematic analysis of the planetary theories in the time of Antikythera mechanism, the anomaly planetary motions that could be demonstrated by a pin-in-slot device are completely understood. By the mechanism analysis and the design concept with the minimum numbers of the members, two types of the feasible topological structures and the corresponding design specifications are obtained: Type 1 is a four-bar mechanism with five joints; Type 2 is a five-bar mechanism with seven joints. In addition, the relations of the teeth for the inferior and superior planets are discussed in each possible combination of the planet gears. Moreover, through the study of the historical literature, the astronomical theories and the existing designs, the required design constraints are concluded further. For Type 1 and Type 2 reconstruction designs, one, the design by Edmunds and Morgan, and three feasible designs are respectively synthesized in accordance with the concepts of generalization and specialization. And all feasible designs are identified further for the suitable planets through the identifications of the input types. In conclusion, all generated designs are consistent with the scientific theories and techniques of the subject’s time period and match the surviving evidences.

Key Words: Antikythera mechanism, reconstruction design, planetary mechanism, synthesis of mechanism, ancient machines