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GEOMETRY OF RETRACTABLE ROOFS CONSTRUCTED ON THE BASIS OF MECHANISMS OF HIGHER CLASSES

Keywords: *retractable roof, kinematics, class III mechanisms.*

Retractable roofs are elements of constructional objects, which deserve special attention in terms of geometry, technology and the method for implementing movability [4], [5], [6]. The main reason for their use is the prospect of adaptation of the object as a multifunctional space, which can be used all year round, regardless of weather conditions. An example might be the object of Wimbledon Centre Court, where before the introduction of movable roof covers, due to heavy rainfall, the prestigious Wimbledon tennis tournament often had to be interrupted. In 2009, the object was roofed with movable roof, closing within 10 minutes. Thanks to this, the central tennis court is the place where all the finals and semi-finals of this tournament are played. The roof covering turned out to be an appropriate enterprise. Now there are conducted works to implement a retractable roofing over the tennis court #1, which is also used during the sporting event of Wimbledon.

Roofing of the object Wimbledon Centre Court is supported by 10 steel space trusses, which move thanks to carriages driven by electric motor along a linear track. Moreover, smooth movement of a single segment is supported by the arms and hydraulic jacks belonging to the two class II mechanisms (the so-called quadrangles) [1], [4], [6]. The first of them is connected to roof panels coated with technical fabrics, while the second one preserves the equal distance between the trusses by means of the so-called stabilising arm. Its length determines the maximum distance between the lattice girders (Fig.1).

The authors in their papers [4], [6] attempted to search for new solutions for roofing in the structure of mechanisms. As part of this, there were conducted studies on class II mechanisms, the elements of which carry sliding and rotational movements (Fig. 1) used in the real solutions for movable roofs. The result of these investigations was obtaining an alternative solution with respect to

the object Wimbledon Centre Court, in which, using the same number of truss girders, almost twice larger area of roofing was obtained.

This paper is a further stage of research, under which the authors seek innovative solutions for roofing in terms of the geometry of shape and the method for the movement, using higher class mechanisms, for example class III mechanisms [1], [2], [3]. This type of roofing can be used for roofing smaller spaces, such as terraces, courtyards or amphitheatres. In this case, the attention was directed to the geometrical form of the modelled solutions, where there is possible an exposure of the space beneath the object or a multiple change of roof shape.
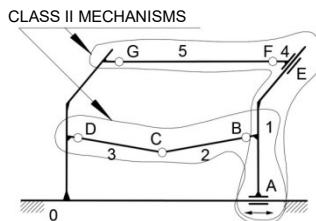

Fig.1. Roof covering of the object Wimbledon Center Court – two class II mechanisms used in transport of one segment of roofing, source: own work.

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