Cable Roof Structure with Flexible Fabric Covering

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ABSTRACT

Cable roof, covered with a flexible fabric membrane, is a low-weight translucent structure. Unlike conventional constructions, comprising steel and concrete elements, fabric covering is set into place in form of large-scale sheets. It reduces amount of site joints and results in diminishing of labour input of the project [1].

Flexible fabric covering is generally used in buildings having significant overall height of the roof. It is suitable for improving architectural appearance of the construction, but usually results in excessive internal space of the building [2]. An approximately flat roof is often much more appropriate for a lot of public and industrial buildings, than the roof having substantial difference between elevations of its ridge and valley. Under this condition the distance between supporting structures of the roof becomes comparatively small in order to ensure required curvature of the membrane. It results in reduction of column spacing and may be unacceptable for buildings, which require large free spans.

In order to overcome this problem, the roof structure, made of preliminary stressed cables, is proposed [3]. The cables are arranged in vertical planes. They are divided into bearer and backstay ones. Backstay cables, to which the flexible fabric covering is attached, are convex upwards. Together with flexible ties they form the upper chord of the proposed roof structure. Bearer cables are convex downwards. They are divided into primary and ordinary ones, which are arranged in mutually-perpendicular directions. Primary bearer cables, equipped with tensioning devices, are connected to columns of the building. Ordinary cables are supported by primary ones.

Calculation formulas, needed for static analysis of the proposed roof structure, are given. They are derived by means of application of trigonometric series for simulation of cable’s structural behaviour. Basic parameters of the roof structure are chosen. They include stiffness of bearer and backstay cables and magnitude of preliminary tension. The technique for estimation of these values is given.

The roof structure is analyzed with the help of the computer program EASY. Various external loadings, including uniform and non-uniform effects, are taken into account.

The proposed construction is intended to be used for public or industrial buildings, having enlarged column spacing. Its primary advantages are diminished overall height, provision of required curvature of the membrane and possibility of tensioning of the whole system by means of small number of cables.

REFERENCES

