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A DESIGN METHOD TO KEEP ASYMMETRICAL RING TRUSS REFLECTOR SURFACE STABLE AND TEST VERIFICATION

Abstract

The surface of the ring truss reflector with asymmetrical networks is not sable when the temperature of reflector is changed. The reason is that the force increments in the two nets caused by temperature are not balanced, which make the surface of the reflector deteriorate when temperature vary. For a reflector, surface error is a very important requirement. So it has academic and practical value to improve the stability of asymmetrical networks in temperature changing environment by parameter matching design. From the requirement, this article induced the design conditions for the asymmetrical ring truss reflector surface to keep stable in changing environment. In order to keep the stability of the surface in horizontal direction, the nodes' coordinate of the front net and the rear net should be calculated by a way that can obtain a uniform tension in front net; In order to keep the stability of the surface in vertical direction, the cables' parameters of the both net should be matched. In order to verify the feasibility of the method, a numberical model is setup. Utilize the method mentioned in this article to solve the nodes' coordinates and the rear net's cable diameter then import the net model into ANSYS. The result showed that the maximum displacement of nodes in the model is $0.17 \times 10^{-9} mm$ at room temperature and is $0.01 mm$ at -60°C temperature which indicate that the structure of net is stable when temperature changing. However, the value got worse when the ring around the net was brought in the model for the deformation of the fringe in the ring was remarkable. But the surface error caused by temperature was still better than the reflector's whose network was designed without considering the two conditions in this article. A $6m$ asymmetrical ring truss reflector same with the numberical model was manufactured. A test locating the reflector in a environment of $\pm 60^{\circ}$C was performed in Xi'an to verify the design method. The result of the test can meet with the data of analysis, which means the design method described in this article is feasible.