

# Experimental Study on Precise Forming of Inflated Membrane Structure Using Airship Membrane Material

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## ABSTRACT

For inflated membrane structure, it is necessary to carry out precise forming analysis, so that the actual shape and stress state of the structure can be as close as possible to the design state. In this paper, in order to verify the effectiveness of an analysis method of precise forming method considering weld seams, a spherical inflated membrane structure using airship membrane material with a diameter of 4 meters is proposed and the applying pressure experiment is completed. In the experiment, a high-pressure blower is used to apply air pressure to the inflated membrane structure in a graded manner. The air pressure levels are 1kPa, 5kPa, 10kPa, 15kPa, 20kPa, 25kPa, 30kPa and the final air pressure is 30kPa. After each level of air pressure is applied and the air pressure and membrane surface deformation are stabilized, the shape and deformation of membrane surface are measured with Electronic Total Station and Laser Scanner. According to the analysis of measuring results, with the increase of air pressure, the annular diameter of the spherical inflated membrane structure increases, while the vertical height decreases, showing a linear change law. When the design pressure is reached, the shape of the structure tends to be spherical. During the whole process of inflation, the diameter measured by the experiment is close to that of finite element simulation. The result shows that the forming results of the 4-meter diameter spherical inflated membrane structure have a high accuracy, and the correctness of analysis method of precise forming is verified. Therefore, the actual shape and stress distribution of inflated membrane structure can be obtained.

**Keywords:** Inflated membrane structure, precise forming, airship membrane material, experiment.