**Abstract**

Most in-service deep pressure hulls are spherical shells, which have the disadvantages of high imperfection sensitivity, irrational hydrodynamics and inefficient space utilization, and these problems are unsolved. Some inspirations could be gained from the eggshell structure with those advantages such as an excellent load-carrying capacity, weight-to-strength ratio, span-to-thickness ratio, and aesthetic appeal. Therefore, our work puts forward a new geometry, an egg-shaped pressure hull, to take place of the spherical pressure hull. Mechanical characteristics comprising ultimate strength and buckling of the egg-shaped pressure hulls proposed based on the geometric function of goose eggshell are explored theoretically, numerically and experimentally. Our study can provides a solid foundation for further applications in deep-sea manned/unmanned submersible.

![Geometry of the egg-shaped pressure hull](image1)

**Results**

1 Biological test of goose eggshells

We measured the geometry including major axis, minor axis, shape, volume, surface area, thickness and shape index, and investigate the mechanical performance including ultimate strength and buckling for goose eggshells.

![Sketch of eggshell and its testing equipment](image2)

2 Investigation on egg-shaped pressure hulls

We established a bionic design method for the egg-shaped pressure hulls. And we conducted a deep study into the buckling of the proposed egg-shaped pressure hulls by comparison of numerical, theoretical and experimental data. Additionally, we also examined the effect of sharp index (SI) and thickness (t) on buckling of these hulls.

![Compressive test](image3)  ![Hydrostatic pressure test](image4)

**Methods**

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![Sketch of goose eggshell and its testing equipment](image5)

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![Compressive test](image6)  ![Hydrostatic pressure test](image7)

**Publications/patents or rewards**


