

Pre-form design for manufacturing CFRP shell structures with optimized fiber-orientation

*Masatoshi Shimoda¹⁾ and Ryosuke Tsukihara²⁾

^{1), 2)} *Department of Advanced Science and Technology, Toyota Technological Institute,
2-12-1 Hisakata, Nagoya, Japan*

¹⁾ shimoda@toyota-ti.ac.jp

ABSTRACT

CFRP shell structures have excellent structural performance based on high specific stiffness, especially with the optimized form and curvilinear fiber orientation. In this study, we focus on the deployment manufacturing, and propose a method for designing the optimal pre-form pattern deployed to manufacture an optimized free-form shell with optimized curvilinear fiber orientation. The propose method consists of two processes: one is to generate the optimal cutlines, and the other is to determine the optimal deployment shape with the cutlines. We formulate a shape optimization problem that minimizes the mapping work from the free-form surface to the plane under the area constraint. The effectiveness of the proposed method is shown through numerical examples.

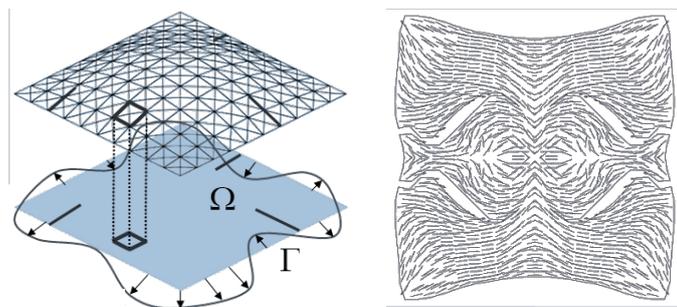


Fig. 1 Deployed CFRP pre-form with optimized fiber orientation

REFERENCES

Shimoda, M. Umemura, M. Ali, M.A and Tsukihara, R. (2023), "Shape and topology optimization method for fiber placement design of CFRP plate and shell structures", *Composite Structures*, 309, 116729.

¹⁾ Professor

²⁾ Graduate Student