

DEVELOPMENT OF OMEGA STIFFENER USING 4D PRINTING OF COMPOSITES

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Abstract

4D Printing of Composites (abbreviated as 4DPC) is a manufacturing technique where a composite structure of complex geometry can be made without the need to use a complex mold. Only a flat mold is used [1]. As such there are significant savings in time and money. The technique can also be used to make structures that conventional manufacturing technique can not. The technique relies on the anisotropic nature of unsymmetric laminates. This technique has been used to make composite leaf springs [2]. In this paper, this technique is used to develop omega shape (Ω) aircraft wing stiffeners. The lay up sequence allows a flat stack of prepregs to transform into the shape of the Ω upon curing and cooling to room temperature. Foam is poured into the cavity of the structure to provide core sandwich support. Figure 1 shows a sample of the composite stiffener made using the technique of 4DPC. The stiffener is tested under three-point bending. The flexural stiffness of the stiffener is determined using a model and laminate theory. The calculated stiffness is compared with experimental results. Good agreement is obtained.

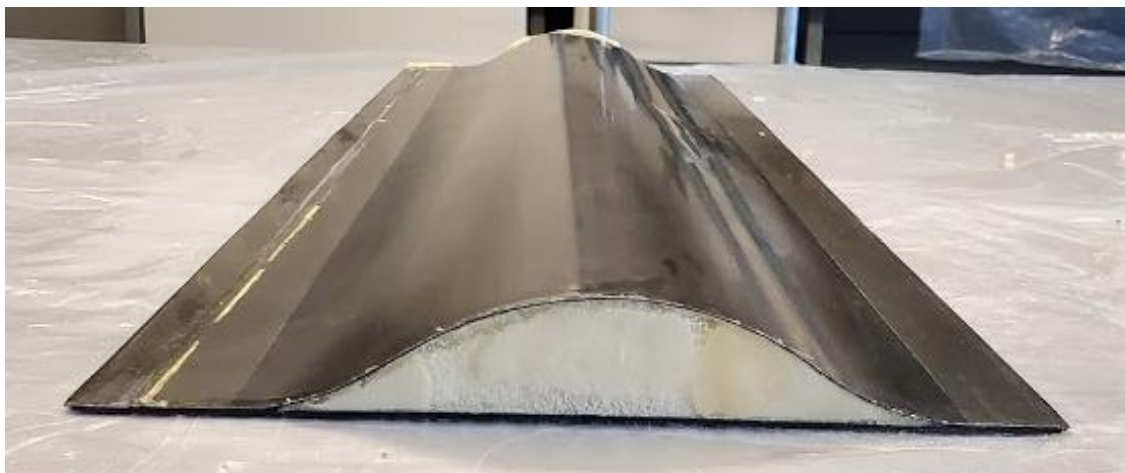


Figure 1: Sample of a composite stiffener made by 4D printing of composites.

References:

- [1]. Hoa Suong. Van., “Factors affecting the properties of composites made by 4D printing (moldless composite manufacturing)”, *Advanced Manufacturing: Polymers & Composites Science*, Vol. 3, No. 3, 2017, pp. 101-109.
- [2]. Hoa Suong Van, “Development of composite springs using 4D printing method”, *Composite Structures*, 210, 2019, pp. 869-876.