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# Study on the Shear Properties of 3D Woven C/C Composites by Developed Digital Image Correlation Technique

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## Summary

Three-dimensional (3D) woven carbon/carbon (C/C) composites have attracted considerable attention in recent years. In comparison to the laminated composites, the carbon composites show better merit due to their strong through-the-thickness properties, high damage tolerance, and dimensional stability. However, the deformation of these materials is usually non-uniform. The strain field distribution is highly dependent on the heterogeneity of 3D woven structure. Therefore, the traditional techniques such as strain gauge are not suitable for measuring the deformation.

In this presentation, a full-field digital image correlation (DIC) technique was developed. The Iosipescu shear test (v-notched beam test) was employed to load the specimen a shear stress field by a material machine MTS 809. Two optical paths with telecentric lens were set up on both sides of the specimen. The speckle images of both sides were continuously recorded during the entire load process. Then their correlations were calculated to obtain the full-field deformation of both sides. After a series of analysis, the shear property of the composite can be obtained. To achieve a good accuracy, some techniques such as pre-rotation algorithm and improved interpolation method were developed during the correlation calculation. The shear test system was evaluated by measuring the property of an aluminum specimen. The measured shear modulus coincided well with the given value (obtained by tensile test). Then this system was used to measure the shear properties of 3D woven C/C composites. One through-the-thickness specimen and seven in-plane specimens with different geometry were tested and their shear stress-strain responses were measured. Their shear chord modulus and strength were obtained. The strain distributions in test section with different specimen geometry were also compared. The results showed that the strain field was extremely non-uniform and fluctuated with the unit cell period of the weave architecture. These results can provide a guidance to accurately measure the properties of woven C/C composites.