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「機械システム・イノベーション」

GMSI

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Multiscale and Multiphysics Analyses of Composites

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Composite materials have distinct hierarchical structures in their length scales even though most engineering analyses assume them as homogeneous materials. In order to better understand and predict their material characteristics, it is critical to apply a multiscale analysis technique to composite materials. Multiscale analyses of composite materials are discussed. A generalized multiscale analysis model has been developed for various composites materials including fiber composites, particulate composites, short fiber composites, etc. Very recently, new failure criteria were proposed for fibrous composite materials. The criteria are based on distinctive failure modes of the constituent materials such as fiber fracture, fiber buckling, matrix cracking and fiber/matrix interface debonding. The criteria use the stress and strain occurring in the fiber and matrix materials.
As composite materials have been considered for various applications, multiphysics analyses received attentions. Especially, for a marine structural application, fluid-structure interaction is one of the problems to be addressed. As a result, analyses of fluid-structure interactions of composite structures are presented. Because the density of water is comparable to densities of polymer composites, fluid-structure interaction plays an important role. Both experimental and numerical studies are discussed.

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