

Predicting Mechanical Property of Fiberreinforced Plastic Considering Microstructure by Numerical Simulation

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In this study, we consider some types of microstructure in the multi-scale simulation to estimate the effect of microstructure. Predicting the mechanical properties of fiber reinforced plastic is essential in assessing the strength of structures. The multi-scale analysis framework can evaluate the macroscopic mechanical property considering the microstructure consisting of fiber and resin. The multi-scale analysis can deal with various types of microstructures, for example, fiber length and number of fibers. Moreover, using fiber orientation tensor reflects the effects of orientation in macro analysis. Some numerical examples perform to evaluate the mechanical properties due to the different microstructure types. Furthermore, we consider the fiber orientation in the microstructure by tensor. Figure 1, Figure 2, and Figure 3 show the various types of unit cell conditions. We consider three models under each situation and compare the numerical results in each case. Figure 4 shows the numerical simulation results and experimental results. We compare the numerical and experimental results in macro simulation to verify the present modeling.

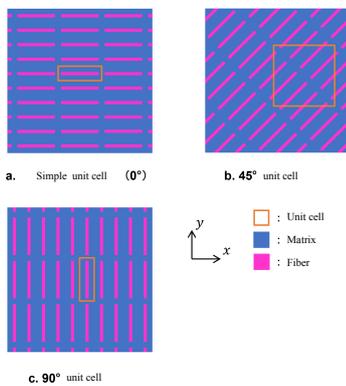


Figure 1 Fiber orientation in unit cell

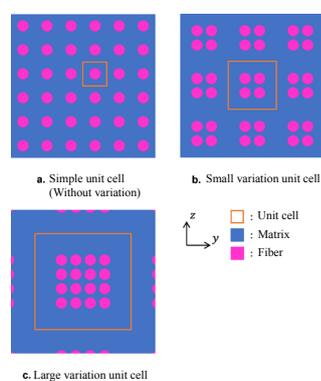


Figure 2 Fiber variation in unit cell

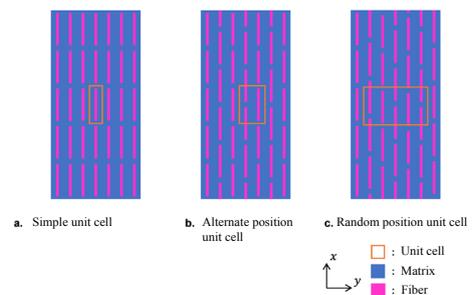


Figure 3 Fiber gap position in unit cell

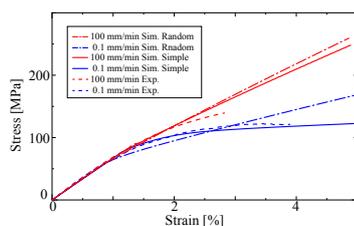


Figure 4 0 degree stress-strain curve in macro simulation