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# Numerical Simulation for Fiber Assembly Orientation in a Newtonian Flow through a 4:1 Abrupt Contraction

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**Abstract:** The objective of the present work is to well understand the mechanism of fiber assembly orientation in various flows involving the processing of composite materials. The evolution of the orientation of fiber assembly in a Newtonian flow through a 4:1 abrupt contraction has been numerically simulated by decoupling flow kinematics with fiber orientation which can be described using the Jeffery equation. It became apparent that (1) two types of abrupt changes in the director angle of fiber assembly were confirmed: the director angle continuously changes through 0° (oscillation phenomenon) and it reaches ±90° (flip-over); (2) fiber assembly completely aligns to the streamline (co-linear alignment) in the contraction for large aspect-ratio fibers and the co-linear alignment can be also observed near the channel wall in the upstream region. Furthermore, the predicted results for fiber orientation qualitatively agreed with the observed phenomena revealed from our previous work.

**Key Words:** Fiber assembly orientation,, Fiber suspension, Jeffery equation, Abrupt contraction flow, Composite processing

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