

GLOBAL COMPOSITES EXPERTS

WEBINAR SERIES 2022-23

CHARLES L. TUCKER III-UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

FIBER ORIENTATION PREDICTION

FIBER ORIENTATION PREDICTION FOR DISCONTINUOUS FIBER COMPOSITES: FUNDAMENTALS AND FUTURE TRENDS



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ABSTRACT

When composite materials with discontinuous fibers are processed into their final shape, any flow alters the fiber orientation pattern and affects the properties of the final composite. It is now standard practice to predict fiber orientation patterns and the resulting mechanical properties in molded parts, and commercial software that can do this is available for injection and compression molding. In this webinar we will look briefly at the history of fiber orientation modeling, discuss the two rules that explain all fiber orientation phenomena qualitatively, and place the many variations of fiber orientation models (ARD, iARD, RSC, RPR, etc.) in context. We will then examine how fiber orientation modeling is likely to develop in the future, including recent innovations in non-orthotropic closure approximations and the reconstruction of orientation distribution functions.



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B I O

Charles Tucker earned bachelor's, master's and Ph.D. degrees in mechanical engineering from the Massachusetts Institute of Technology. Since 1978 he has been on the faculty of the Department of Mechanical Science and Engineering at the University of Illinois at Urbana-Champaign, where he is currently the Alexander Rankin Professor Emeritus.

Dr. Tucker's research focuses on manufacturing processes for polymers and composite materials. His models for predicting flow-induced fiber orientation are used worldwide in all software packages for simulating injection molding, and his seminal paper on orientation tensors has over 1,000 citations. He has also studied compression mold filling, resin transfer molding, microstructure development in polymer blends, and mixing in chaotic laminar flows. He has advised 50 master's, Ph.D., and post-doctoral students.

Dr. Tucker is a Fellow of the American Society of Mechanical Engineers and was one of the first three researchers to be named a Fellow of the Polymer Processing Society. He edited the book Fundamentals of Computer Modeling for Polymer Processing and, with his colleague Jonathan Dantzig, wrote, Modeling in Materials Processing. He recently published his third technical book, Fundamentals of Fiber Orientation: Description, Measurement and Prediction (Hanser, 2022).

From 2013 to 2017 Dr. Tucker served his university as Vice Provost for Undergraduate Education and Innovation. In that role he provided campus-wide leadership in undergraduate education; increased enrollments, student diversity, and financial aid; and supported innovations in classroom and online instruction.