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These days, advanced multiscale hybrid materials are being produced in the industry, studied by universities, and used in several applications. Unlike for macromaterials, it is difficult to obtain the physical, mechanical, electrical, and thermal properties of nanomaterials because of the scale. Designers, however, must have knowledge of these properties to perform any finite element analysis or durability and damage tolerance analysis. This is the book that brings this knowledge within easy reach.

What makes the book unique is its approach that combines multiscale multiphysics and statistical analysis with multiscale progressive failure analysis. The combination gives a very powerful tool for minimizing tests, improving accuracy, and understanding the effect of the statistical nature of materials, in addition to the mechanics of advanced multiscale materials, all the way to failure. The book focuses on obtaining valid mechanical properties of nanocomposite materials by accurate prediction and observed physical tests, as well as by evaluation of test anomalies of advanced multiscale nanocomposites containing nanoparticles of different shapes, such as chopped fiber, spherical, and platelet, in polymeric, ceramic, and metallic materials. The prediction capability covers delamination, fracture toughness, impact resistance, conductivity, and fire resistance of nanocomposites. The methodology employs a high-fidelity procedure backed with comparison of predictions with test data for various types of static, fatigue, dynamic, and crack growth problems. Using the proposed approach, a good correlation between the simulation and experimental data is established.



Frank Abdi is the chief scientist of AlphaStar Corporation. He has over 35 years' experience in computer-based modeling and software development for a range of applications associated with advanced composite materials and structures, durability and damage tolerance, and aircraft certification. Before founding ASC, he worked at Boeing/Rockwell Aerospace advanced program. He has published more than 200 journal articles and conference papers. Dr. Abdi received a BS and MS in mechanical engineering from the University of Michigan (1974–1975) and a PhD in mechanical engineering from the University of Southern California (1980). He currently serves as adjunct professor at UCLA and as visiting professor at Imperial College London. He is the recipient of several awards, including NASA Software of the Year (1999), R&D 100 (2000, 2015), US Senate Tibbets Award (2001), and NASA Columbia Accident Investigation Award (2003).



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