Chapter Three

MICROMECHANICS

ROLE OF MICROMECHANICS

Beginners in the field of composite mechanics may be awestruck by the basic concepts of micromechanics. Because of this, and also because I was one of the awestricken at the time, some effort was devoted to preparing an introductory chapter on this topic for the book edited by G. P. Sendeckyj. The chapter was intended to provide a carefully prepared article in which physical explanations are used in addition to the appropriate mathematical formulations. While the study of micromechanics per se was not a major driver of structural composites technology at the time, this activity was very helpful to the author many years later in the study of ceramic composites, where the micromechanics issues become critical. In the various graphite–epoxy systems, micromechanics primarily served to provide estimates of effective moduli and transverse fiber properties, not for strength or optimization predictions. The unidirectional layer served as a convenient tool for characterization and lamination theory provided as effective means of stress analysis in regions away from severe stress concentrations such as notches and edges. In conjunction with semi–empirical strength hypothesis these were easily accomplished and were quite successful for initial design.