

Chapter One

SOME BASIC STUDIES OF COMPOSITE BEHAVIOR

TESTING

Structural composites such as glass-, graphite-, and boron-epoxy came into prominence in the 1960's. Although there existed a well established theoretical basis in the Soviet literature and considerable practical, experimental research at the U.S. Forest Products Laboratory, the concepts of anisotropy and heterogeneity were not widely taught in this country and were foreign and confusing to most engineers. Two areas needing immediate attention before structural usage during this period were modeling of anisotropic and laminated systems and experimental characterization. The first few papers [1-3] examine the latter issue. It is important to establish the needed material properties, which in turn requires proper experimental procedures that provide true material properties and not artifacts of the way in which a test specimen is constrained during the tests.

Shear coupling—probably a mysterious concept at the time—requires delicate care in testing as it produces extraneous bending and shearing if it is not permitted to occur freely. The first paper provides a 2D elasticity analysis which can be used to determine the severity of the effect and the parameters it depends upon. The model gives a convenient closed-form solution in which the boundary constraints are approximated that can be used to guide further modeling by numerical means (such as FEM) where the property dependence is not explicit. The model is still widely used in experimental design.