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Modeling of structure and mechanics of fibrous assemblies used for composites

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Abstract

Specific behavior of textile composites is determined by textile reinforcement. Influence of textile part on the architecture of composites is based on their typical fibrous construction. Mathematical models of some specific structural properties are presented in this contribution. The lawful way for derivation of fiber orientation and dimensions of pores among fibers is presented in our own theoretical concept. The compression of fibrous assemblies and loading of fiber bundles are presented by our original mathematical models, too. Generally, this work documents - in four examples - very specific textile influence on the behavior of whole textile composite.

Key words: *Fibrous assemblies, Orientation, Pores, Compression, Tensile behavior*

1. Introduction

The specific fiber properties and the structure of a fibrous assembly define the properties of composites. Since the composites are usually used in technical applications, the risk of failure should be minimum, therefore a complete identification and description of the structures used to make composites is very important. There are some existing models available for describing the composites, but they are often too simple to be precise enough precise. One can very well understand that it is sometimes impossible to formulate exact models that can accurately describe the behavior of real composites, however, an acceptable model is able to simulate the behavior of real composites as precisely as possible. This article reports some new and modified models of fiber assemblies used for composites. This includes models of fiber orientation, pores among fibers, compression of fiber assemblies and mechanics of slake fiber bundles.

2. Model of fiber orientation

The arrangement of fibers in a fibrous assembly should be described by its directional arrangement, besides by its packing characteristics. The directional arrangement of fiber is sometimes referred as fiber orientation. Fiber orientation affects primarily geometrical and mechanical properties (e.g., forces, stress, fiber velocity, etc.) of fibrous assemblies.

Fiber orientation determines the anisotropic mechanical properties of fiber layers from which some non-woven or reinforced textile composites are produced. Sometimes different fiber arrangements in a fibrous assembly are required to meet some predefined mechanical properties. There are several sophisticated

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