CHARACTERIZING NONWOVEN FIBROUS MATERIALS VIA REALISTIC MICROSTRUCTURAL SIMULATION

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A physics-based nonwoven structure generation model and its application in studying wetting behavior of fibrous structures will be presented in this talk. The structure generation model developed in this work is capable of incorporating the mechanical properties of the fibers in the simulations by treating each fiber as an array of beads connected to one another via springs and dampers. This also allows the model to realistically simulate the bending of the fibers at fiber–fiber crossovers. In fact, a unique attribute of the modeling approach presented in this work is that it can be modified to emulate the manufacturing process by which a nonwoven media have been produced. To study wetting properties of nonwoven media, two different approaches were considered; one based on surface energy minimization (highly accurate, but hard to implement when the fibers are randomly oriented), and the second through a simplified force balance method (less accurate, but easy to implement). The results of our numerical simulations are discussed in the context of contemporary literature.