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Kenneth M. Golden* (golden@math.utah.edu), University of Utah, Department of Mathematics, 155 S 1400 E RM 233, Salt Lake City, UT 84112-0090. *Random microstructures and phase transitions in composite materials*. Preliminary report.

Composite materials can exhibit sharp transitions in their effective behavior as some parameter of the system is varied. For example, sea ice is a composite of pure ice with brine inclusions. The volume fraction and connectedness of these inclusions change significantly with temperature. Below a critical brine volume fraction of around 5%, sea ice is effectively impermeable to fluid flow, and is increasingly permeable above this threshold. This critical behavior controls a broad range of processes in sea ice which are important for studies of climate change, as well as for microbial ecosystems living in sea ice. Similarly, electrorheological fluids, which are suspensions of particles in a viscous fluid, undergo a sharp fluid/solid transition as an applied electric field exceeds a critical value. In this talk we'll discuss some mathematical approaches to describing the behavior of such systems. (Received February 22, 2010)