

Materials Science & Engineering Doctoral Defense

Modeling complex material systems using stochastic reconstruction
and lattice particle simulation

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abstract

Complex composite materials consist of two or more materials with different properties that form regions large enough to be regarded as continua and which are usually firmly bonded together at the interface to give the composite unique properties. Composite materials are key to many performance-critical structural applications that range from automotive to aerospace transportation because of superior mechanical, thermal and other properties, such as light weight, high strength, corrosion resistance, etc. In this study, three complex material systems including a novel class of hyperuniform composite materials with superior mechanical properties, collective dynamic behavior of the embed tumor cells in cellularized collagen gel and low melting point alloy (LMPA) composite with good rigidity tunability in soft gripping are investigated, using statistical pattern characterization, stochastic microstructure reconstruction and micromechanical analysis.