"Multiscale Mechanics of Bioinspired Material Intelligence"

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Digital biomaterials are designed through an integrated approach of large-scale computational modeling, material informatics, and artificial intelligence/machine learning to optimize and leverage novel smart material manufacturing for advanced mechanical properties. Through the use of nanotechnology and additive manufacturing, and bio-inspired methods, we can now mimic and improve upon natural processes by which materials evolve, are manufactured, and how they meet changing functional needs. In this talk we show how we use mechanics to fabricate innovative materials from the molecular scale upwards, with built-in bio-inspired intelligence and novel properties, while sourced from sustainable resources, and breaking the barrier between living and non-living systems. Applied specifically to protein materials, this integrated materiomic approach is revolutionizing the way we design and use materials, and has the potential to impact many industries, as we harness data-driven modeling and manufacturing across domains and applications. The talk will cover several case studies covering distinct scales, from spider webs and silk, to collagen, to biomineralized materials, as well as applications to food and agriculture, and focuses on mechanistic insights using scaling laws and size effect studies.