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Abstract for an Invited Paper
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Challenges for Polymer Theory and Simulation

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I will discuss some contemporary topics in polymer physics that represent challenges for theorists and computer simulators in the coming decade. These are:

- The challenge of multiple scales – bridging the atomistic to the continuum
- Structure-property relations for nanocomposites
- Supramolecular polymer assembly
- Science and engineering of conjugated polymer interfaces – electronic structure meets polymer physics
- Rheology and structure of inhomogeneous polymers
- Ultimate mechanical properties of everything polymeric

There are common aspects to these challenging topics; for example, multiple scales and the curse of dimensionality are pervasive. My presentation will touch on the theoretical tools that are needed to conduct research in these areas, and will highlight a few contributions from my own group.