Abstract:
One of the most exciting areas in colloid research is the control of interparticle interactions to generate new structures. The ease of tuning interactions, size, shape, and composition has made these nano- and micron-sized particles appealing probes for a number of fundamental studies. Recent work has focused on the use of colloidal particles that can act as models for studying the fundamental phenomena of atomic systems. The self-assembly of these “colloidal atoms” has led to investigations of the dynamics of chemical transformations such as nucleation or phase transitions. I will describe the application of time-varying magnetic fields to induce new dynamical phases. A phenomenon we have recently identified is how interfacial shear at the boundary of the void-crystal interface leads to the generation of low-angle grain boundaries, typically found in hard condensed matter systems. Another system that we have investigated is chains comprised of micron-sized paramagnetic particles that have been linked together with DNA. We have shown that these chains can be engineered with persistence lengths (the length scale for bending) that vary over five orders of magnitude, ranging from rigid, semiflexible, and flexible. Using this model filament, we have studied the dynamics of these filaments in various force and flow field environments, where the relative roles of external, viscous, and elastic forces on the filament can be manipulated to study buckling and coiling. Our results promise to open up new insights into magnetically actuated materials.

Biography:
Dr. Sibani Lisa Biswal is the William M. McCardell Professor and Associate Chair in the Department of Chemical and Biomolecular Engineering and Associate Dean for Faculty Development in the George R. Brown School of Engineering at Rice University in Houston, Texas. She has a B.S in chemical engineering from Caltech (1999) and a Ph.D. in chemical engineering from Stanford University (2004). She is the recipient of an ONR Young Investigator Award (2008) and a National Science Foundation CAREER award (2009). She has received the George R. Brown Award for Superior Teaching (2015), the Rice University Chemical Engineering Alumni Professional Progress Award (2017), and the South Texas Section American Institute of Chemical Engineers Best Applied Paper Award (2018). She was selected as a 2020 Fellow in Drexel University’s Executive Leadership in Academic Technology, Engineering, and Science (ELATES) program. She leads the Soft Matter Engineering Laboratory, where she aims to connect a fundamental understanding of the interfacial forces and transport governing soft matter systems to identify new insights and ideas towards engineering new solutions for a variety of critical technological problems.