Liquid biopsy is an appealing paradigm in early diagnosis, prognosis, and precision treatment of cancer, as tissue biopsy is highly invasive, costly, and often infeasible to repeat. Extracellular vesicles (EVs), including exosomes, are emerging as a new modality of liquid biopsy for cancer diagnosis and precision medicine. However, it remains challenging to isolate and measure these diverse nanosized vesicles in biological samples. In this talk, I will discuss our recent progress in engineering of microfluidic systems, nanomaterials-based biosensors, and the CRISPR/Cas12a system to substantially improve isolation and molecular profiling of tumor-derived EVs with minute sample consumption. Adaptation of these new technologies to clinical profiling of circulating EVs will be demonstrated for diagnosis and monitoring of a variety of solid tumors, including breast cancer, ovarian cancer, and pediatric Ewing Sarcoma. Our technologies were seen to improve the diagnostic power of the EV-based liquid biopsies compared to the conventional tests, which suggests their potential of translation into biomedical research and clinical utilities. Overall, these multi-modal engineered systems would provide enabling biosensing capabilities to promote early diagnosis of tumors and precision oncology.
Dr. Zeng is an associate professor and the head of Analytical Division in the Department of Chemistry at the University of Florida. He is also an affiliate faculty of UF Biomedical Engineering and a member of UF Health Cancer Center. His research draws on chemistry, material sciences, bioengineering, and medicine to develop innovative micro and nanoscale tools to advance precision medicine of challenging diseases, in particular cancer. His technology innovations span from biomolecular assays to lab-on-a-chip systems and to smart biosensor powered by robotics and artificial intelligence (AI) for sensitive and quantitative measurements of liquid biopsies and biomarkers, including extracellular vesicles (EVs), proteins, and nucleic acids. Specifically, he is internationally recognized for his pioneering research in developing microfluidic technologies for isolation and analysis of tumor-derived EVs, an emerging paradigm of liquid biopsy for cancer diagnostics and therapeutics. He is devoted to translational research to bring the technological innovations from the benchtop to bedside, working with biologists and clinicians. His work has led to many highly visible publications on top-tier journals, including *Nat. Biomed. Eng.* and *Sci. Transl. Med.*, which were featured on numerous news coverage in professional and public media outlets such as the NIH Director’s Blog and the JAMA Network.