Resolving all the energy-containing scales in a high Reynolds number wall-bounded flow is computationally costly. A more cost-effective alternative is to resolve the relatively large scales and model the near-wall small-scale eddies. This leads to wall-modeled large-eddy simulations (WMLES), where the effects of the near-wall eddies are modeled by a wall model. The most extensively used wall model assumes equilibrium, which falls short when the flow is subjected to pressure gradient or system rotation. Resorting to available high-fidelity direct numerical simulation (DNS) datasets and modern machine learning tools, in this talk, we will present wall models that work well for flows subjected to pressure gradients and system rotation. This study shows that the data-based modeling approach can be useful alternatives to the physics-based modeling approach.

Bio: Dr. Xiang Yang is an assistant professor in the mechanical engineering department at Penn State University. He got his Ph.D. in mechanical engineering in 2016 from the Johns Hopkins University and was a postdoctoral researcher at the Center for Turbulence Research for about one and a half years, after which he joined Penn State. Yang’s research focuses on turbulence simulation and modeling.