JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Friday, September 13, 2019
3:00 PM, 132 Gilman Hall

"Towards Physically Exact RANS-LES"

Presented by Prof. Stefan Heinz

University of Wyoming - Department of Mathematics

Hosted by Prof. Charles Meneveau (Mechanical Engineering)

Accurate and feasible simulations of turbulent flow around aircraft and wind turbines suffer from two major problems. On the one hand, computationally very efficient pure Reynolds-averaged Navier-Stokes (RANS) methods fail to describe the main features of such flows because of their lacking ability to resolve turbulent flows. On the other hand, pure Large Eddy Simulation (LES) methods, which are capable of simulating resolved flow, are computationally too expensive for real wall-bounded turbulent flows. The development of solutions to these problems via the design of hybrid methods involving both RANS and LES elements takes place now over decades. About a thousand research papers (following a huge variety of solution strategies) are published every year now. First, previous applications of hybrid methods are illustrated by focusing on hill-type flows involving flow separation. These applications reveal both the potential of hybrid methods and significant problems. The talk focuses then on the solution of some essential problems that were basically unaddressed so far, for example the question of how resolved and modeled turbulent motions can be kept in balance under changing resolution conditions. A theoretical solution to this question is presented for several well-known turbulence models. Applications illustrate the potential of these new simulation methods.