Proceedings of CHT-15
ICHMT International Symposium on Advances in Computational Heat Transfer

May 25-29, 2015, Rutgers University, Piscataway, USA

CHT-15-251

DNS STUDIES OF MULTIPHASE FLOWS

Gretar Tryggvason[*,§]
[*]Department of Aerospace and Mechanical Engineering,
University of Notre Dame, Notre Dame, IN, USA
[§]Correspondence author. Email: gtryggva@nd.edu

ABSTRACT Direct Numerical Simulations (DNS) of multiphase flows, where every continuum length and time scale are fully resolved, currently allow us to simulate flows of considerable complexity, such as the motion of several hundred bubbles in turbulent flows. As progress has been made, new challenges have emerged. Those include the use of DNS results for the development of closure relations of unresolved processes in simulations of large-scale industrial systems and how to capture features that are much smaller than the dominant flow scales. We discuss recent results for bubbles in turbulent channel flows and how DNS is helping us understand the dynamics of the flow and providing data that we can "mine" to get closure terms for averaged models. So far the strategy has only been used for simple systems but a similar approach is likely to work for more complex systems. We also discuss the use of embedded analytical descriptions to capture thin films and mass transfer boundary layers, in combination with direct numerical simulations of the rest of the flow. We conclude by discussing future directions in computations of complex multiphase flows.