Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Higher-order accurate asynchrony-tolerant schemes for CFD at extreme scales ADITYA KONDURI, DIEGO DONZIS, Texas A&M University — With increasing computational power, simulations of fluid flows are routinely being done on hundreds of thousands of processing elements (PE). At these extreme scales communication between PEs take a substantial amount of the total time. In future Exascale, communication time is likely to overwhelm computing time and affect the scalability. Our recent work on asynchronous method based on finite-differences has shown the feasibility of carrying out computations in absence of data synchronization between PEs, reducing the communication time significantly. However, accuracy of commonly used schemes is affected and the error depends on the characteristics of the computing system. In this work, we develop new higher-order accurate schemes that are asynchrony-tolerant. We present a framework in which schemes with desired accuracy can be constructed taking into account machine-specific characteristics to trade off communication by memory or computation effort and quantitatively control the error introduced by asynchrony. We design schemes, prove their properties using model equations and evaluate their performance using simulations of more realistic equations. These schemes will enable us to perform high-fidelity simulations of turbulent flows at extreme scales with good scalability.

Aditya Konduri
Texas A&M University

Date submitted: 01 Aug 2014 Electronic form version 1.4