Department of Mathematics & Statistics

LOYOLA UNIVERSITY MARYLAND

Departmental Seminar Series *presents:*

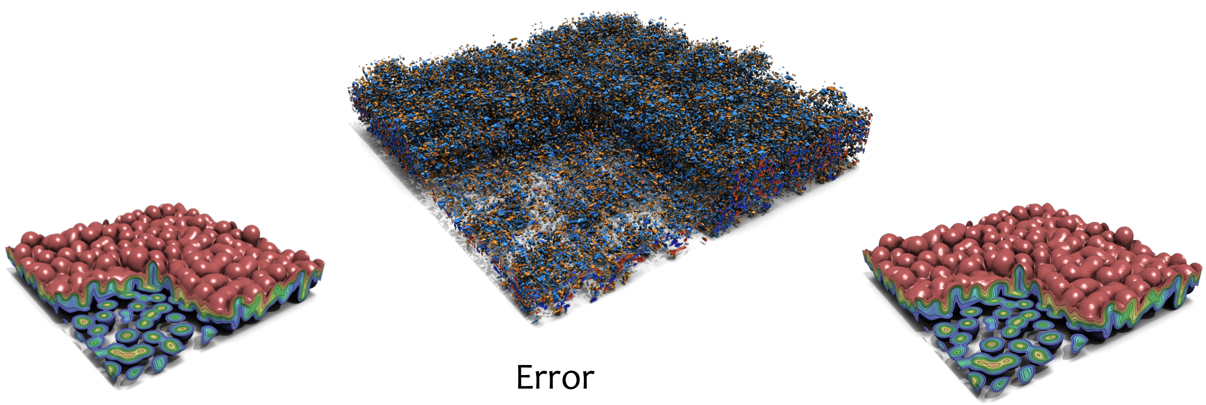
Dr. Alyson Fox ‘12

Lawrence Livermore National Laboratory

Center for Applied Scientific Computing

November 12, 2018, 3:00 pm KH 309

Error Analysis of ZFP Compression for Floating-Point Data



Original Data — Error — ZFP = 318x smaller!

Abstract:

Compression of floating-point data will play an important role in high-performance computing as data bandwidth and storage become dominant costs. Lossy compression, an inexact approximation, of floating-point data is powerful, but theoretical results are needed to bound its errors when used to store look-up tables, simulation results, or even the solution state during the computation. In particular, I have been studying ZFP, a state-of-the-art, lossy compression algorithm built specifically for floating-point data. ZFP can easily be used inline during numerical simulations due to the built-in local structure of the algorithm. In a numerical simulation, the solution state already contains traditional errors, e.g., floating-point round-off error, truncation error, and discretization error. The information that is lost during ZFP could represent the traditional errors, however, any additional error caused by ZFP will contaminate the current iterate. In this talk, I will present theoretical bounds for both a single use and an inline use of ZFP. In order to tightly bound the error, we first introduce a vector space that allows us to work with binary representations of floating-point numbers. Under the vector space components, we define operators that implement each step of the ZFP compression and decompression to establish a bound on the error caused by a single use of ZFP. Under some basic assumptions, we can generalize the single use error bounds to show that the error caused by ZFP, when used inline, is bounded as it propagates through the simulation by a discrete advancement operator.

This talk will be accessible to Juniors and Seniors.

Refreshments will be served.