A complex-step method for tangent-stiffness calculation in a massively parallel computational peridynamics code

A. Goals: (Remaining)
- Confirm desktop results on Stampede cluster
- Meet or exceed the speed of Automatic Differentiation with Complex Step

B. Brief Description:
- Complex step can calculate the first order partial derivatives needed to create a tangent stiffness matrix, and can be implemented in pre-existing solver code for superior accuracy over finite difference

C. Heights of Achievements this semester:
- Achieved accuracy superior to finite difference over a range of problem complexities
- Achieved performance similar to AD and finite difference over a range of problem complexities
Comparing Speed Performance

Wall Clock Jacobian Calculation Time Vs. Problem Size, for Each Method

- Complex Step
- Automatic Differentiation
- Central Difference
- Forward Difference

Time (seconds)

Rounded Number of Mesh Nodes: 1000, 2000, 3000, 4000

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Comparing Accuracy Performance

Log Index of Scaled Root Mean Squared Error in Stiffness Matrices Vs. Problem Size, for Alternative Vs. AD

- **Complex Step**
- **Central Difference**
- **Forward Difference**

Rounded Number of Mesh Nodes