Modeling ICF Spherical Implosion Instabilities in 3D with Exact Energy Conservation
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Summary

**Abstract**

We will present the results of simulating spherically symmetric implosions on spherical magnetic shells. No simplifications are assumed and a hydrodynamic code, called cooper, is used to perform the simulations. Cooper is designed to offload several tasks to a pre/post processor. It is parallelized using domain decomposition to allow it to run on large processor counts. Cooper is designed to efficiently store, write and read large amounts of scientific data in parallel.

**Future Work**

- Implement an accurate and conservation aware non-linear fluid solver.
- Extend the grid generation to include non-uniform grids.
- Implement diffusion solvers that function on non-uniform grids.
- Implement full-limiter with group radiation diffusion.
- Implement full-limiter with group radiation diffusion.

**Cooper can run simulations in convergent geometries with non-uniform zoning.**

**Non-uniform zoning can be used to impose a localized perturbation.**

**Conclusion**

- ICF spherical implosion instability has been studied using a hydrodynamic code called cooper. The code uses a compatible hydrodynamics framework which guarantees global energy conservation.
- Non-uniform zoning is important for modeling localized structures such as fill tubes.
- Future work includes extending the thermal conduction model and developing an active perturbation method to study the growth of spherical instabilities.

**References**

3. Cooper is designed to offload several tasks to a pre/post processor.

**Code Design**

Several computational tools are used to simplify cooper without sacrificing performance.

- The MOAB library manages the mesh for cooper and handles parallel communication.
- The mesh is generated by the user and provided as input to cooper.
- The MOAB library is used to manage the mesh internally. MOAB also provides the capability to "tag" data to cells, faces, edges or vertexes.
- Data can be "preprocessed" to cooper's HDF5 output to other formats, such as HDF5 or XML.
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