The Loci
Multidisciplinary Simulation System

Status and Update
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Outline of Topics

- An Overview of the Loci Multidisciplinary Simulation System
- Topologically adaptive mesh generation
- Multidisciplinary simulations using Loci with the CHEM chemically reacting flow solver
Automatic Synthesis of Tightly Coupled Multidisciplinary Scalable Parallel Simulations
Loci: What is Simulation Synthesis?

- Applications are described by a collection of computational rules.
- Computational rules have simple semantics (fundamental components).
- Rules are automatically synthesized into applications based on inputs and user query.
- Synthesized application is checked for logical consistency and is transparently able to use parallel computers such as distributed memory commodity clusters.
Loci: Applications as Knowledge Repositories
Finite Volume Solution Method on Arbitrary Polyhedra
Validation of Numerical Results

Heat Transfer downstream of an abrupt pipe expansion

- Menter's BSL model
- Menter's SST model
- cubic k-ε model [3]
- k-ε-R model [3]
- exp. data [1]
Low Speed Combustion using Preconditioned Reactive Roe Flux

- Uses robust Chorin-Turkel preconditioning method
- Time derivatives in conservative variables
- Newton Iterations transformed to primitive variables (gauge pressure, Temperature, velocity, mass fractions)
Laminar Methane Flame

- A low speed combustion flow case is used to validate low speed capabilities
- Preconditioning + new time integration method used for numerical model
- Flame simulation neglected radiation and used a reduced mechanism (global) reaction model for methane combustion
- Results of flame height and temperatures similar to results of Smooke (used detailed reaction model, no radiation)
- Results compare well to experiments