

**Newton-Krylov-Schwarz Methods for
Structured and Unstructured
External Aerodynamics Problems**

Dinesh Kaushik and David Keyes

Computer Science Dept., Old Dominion Univ. &

ICASE, NASA Langley Research Center

and Lois McInnes and Barry Smith

Mathematics and Computer Science Division,

Argonne National Laboratory

Outline of Presentation

- *New axes* onto which to project an old debate
- Parallel pseudo-transient Newton-Krylov-Schwarz solvers
- Structured CFD application: JULIANNE
- Unstructured CFD application: FUN3D
- Unstructured implementation of structured problem
- Performance comparisons
- Future directions

Structured versus Unstructured: Previous Points of Debate



Structured versus Unstructured: New Points of Debate



Why Parallel Implicit Nonlinear Methods?



Newton-Krylov-Schwarz

Pseudo-transient Newton-Krylov-Schwarz



PETSc Implementation of Ψ NKS Methods

Recent References on Ψ NKS Methods



Structured CFD application: JULIANNE



Sample C-H Grid for M6 Wing Geometry

Sample Per-node and Aggregate Performance Results

Unstructured CFD application: FUN3D



Sample Tetrahedral Grid for M6 Wing Geometry

Sample Per-node and Aggregate Performance Results

Unstructured Implementation of Structured Code

-

Structured Grid Primitive and Dual Cell Geometry

Per-Node Performance Comparisons

Parallel Scalability Comparisons

Preliminary Conclusions



Future Directions

