MPP Implicit for LS-DYNA v. 971

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The Vision

- LSTC wants to provide a single package that allows users to perform all of their analyses.
  - Implicit computations must be integrated with explicit
  - Linear analyses (useful for debugging large models) must be integrated as well.

Implicit Computations

- At LSTC we have developed an integrated package that allows us to switch between implicit and explicit computations in the same simulation.
- We have added many linear analyses
  - Linear Static,Vibration, Buckling
- All are now available in MPP

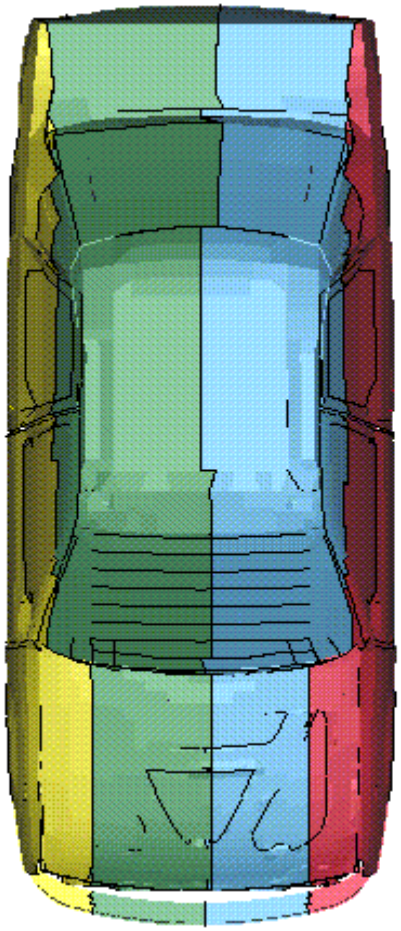
Implementation Restriction

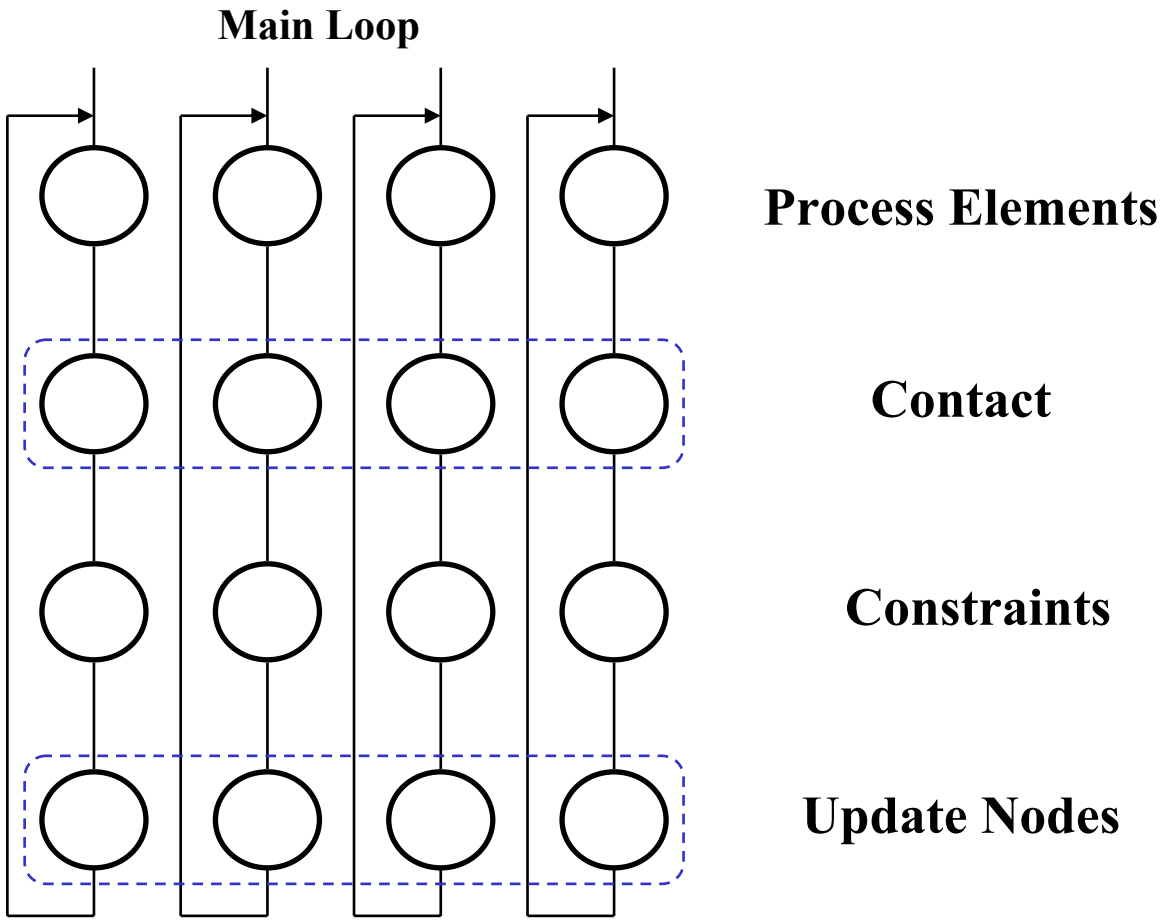
- MPP Implicit must be a complete end-to-end implementation
- No part can be left in serial (like our competitors)

Explicit Implementation

- Explicit partitions the problem into subproblems executing on each processor
  - Strict partitioning of elements
  - Nodes may be on more than one processor
  - Load balance for explicit driven by elements and contact
    - May be bad for parallel linear algebra

Explicit MPP Parallelism





Implicit Uses Explicit

- Implicit uses already existing explicit computations for
  - Element matrix computations
    - Force
    - Stiffness
  - Contact

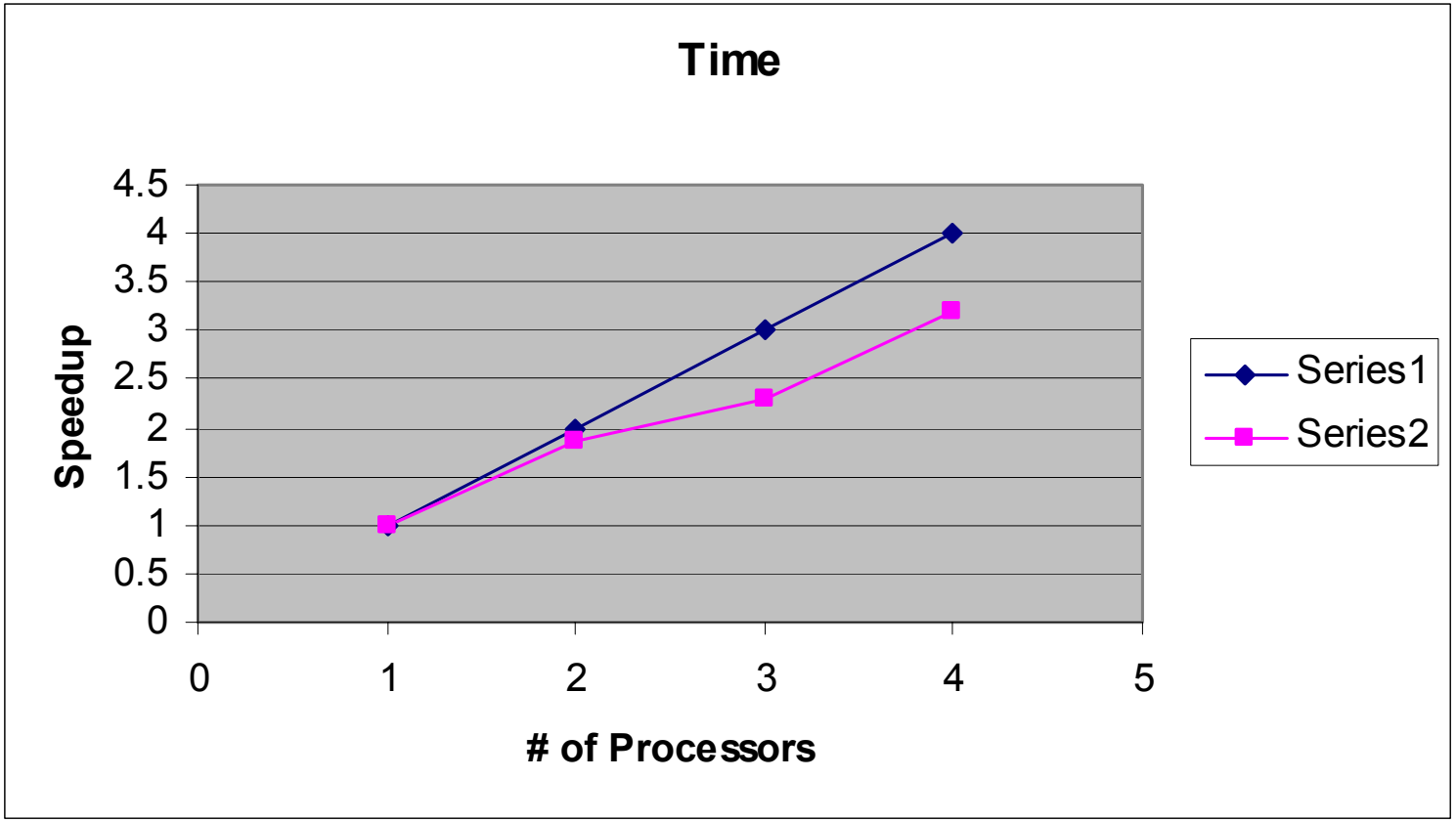
MPP Implicit

- To make MPP LS-DYNA Implicit we have developed
  - A distributed memory matrix assembly and constraint application package.
  - A distributed memory parallel linear equation solver based on multifrontal
  - A parallel eigensolver based on Boeing's Lanczos software and our linear equation solver.
- All major efforts.

Parallel Linear Equation Solver

	Wall Clock (minutes)	Memory
Serial	131	678 Mw
MPP-1 proc	154	682 Mw
MPP-2 proc	88	366 Mw
MPP-3 proc	73	231 Mw
MPP-4 proc	55	210 Mw

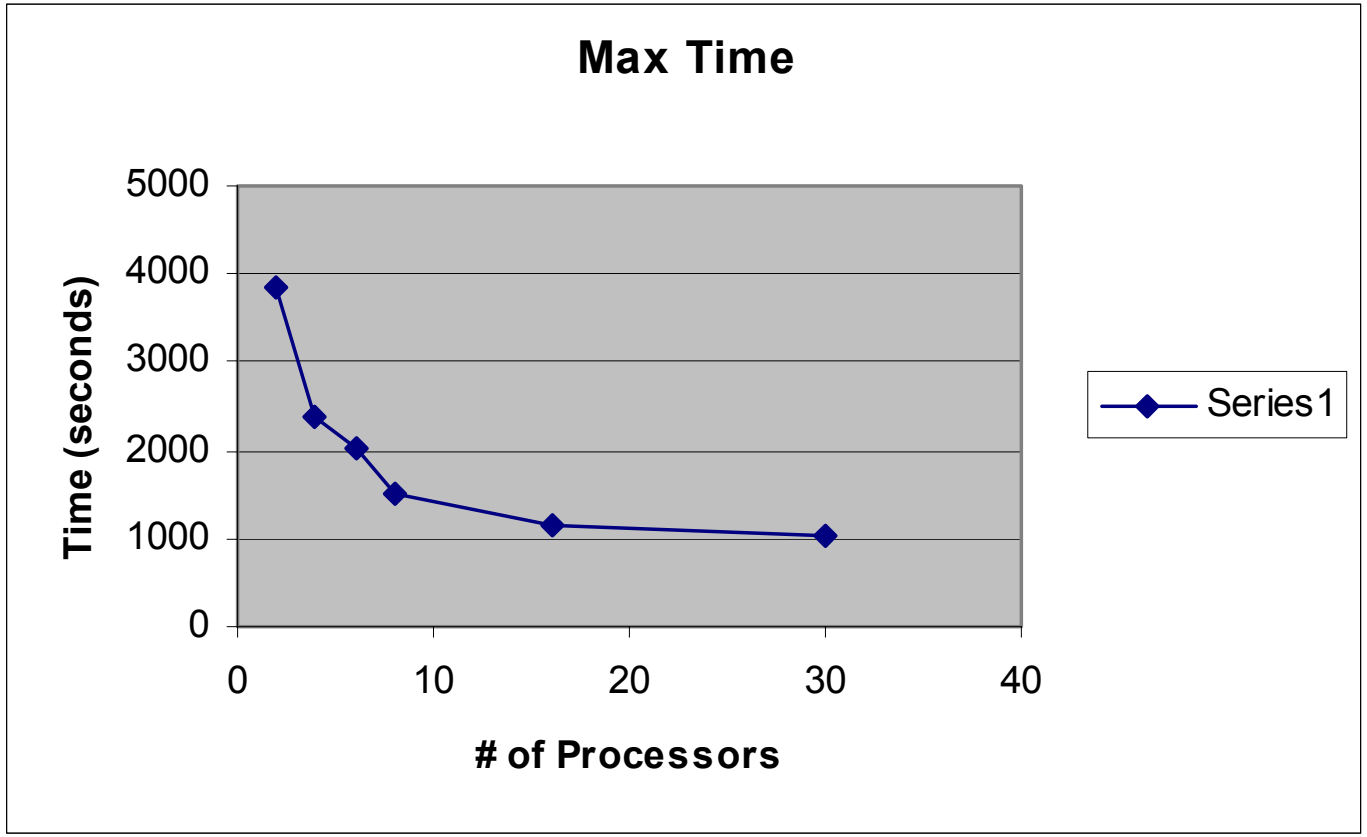
Plot of Speedup



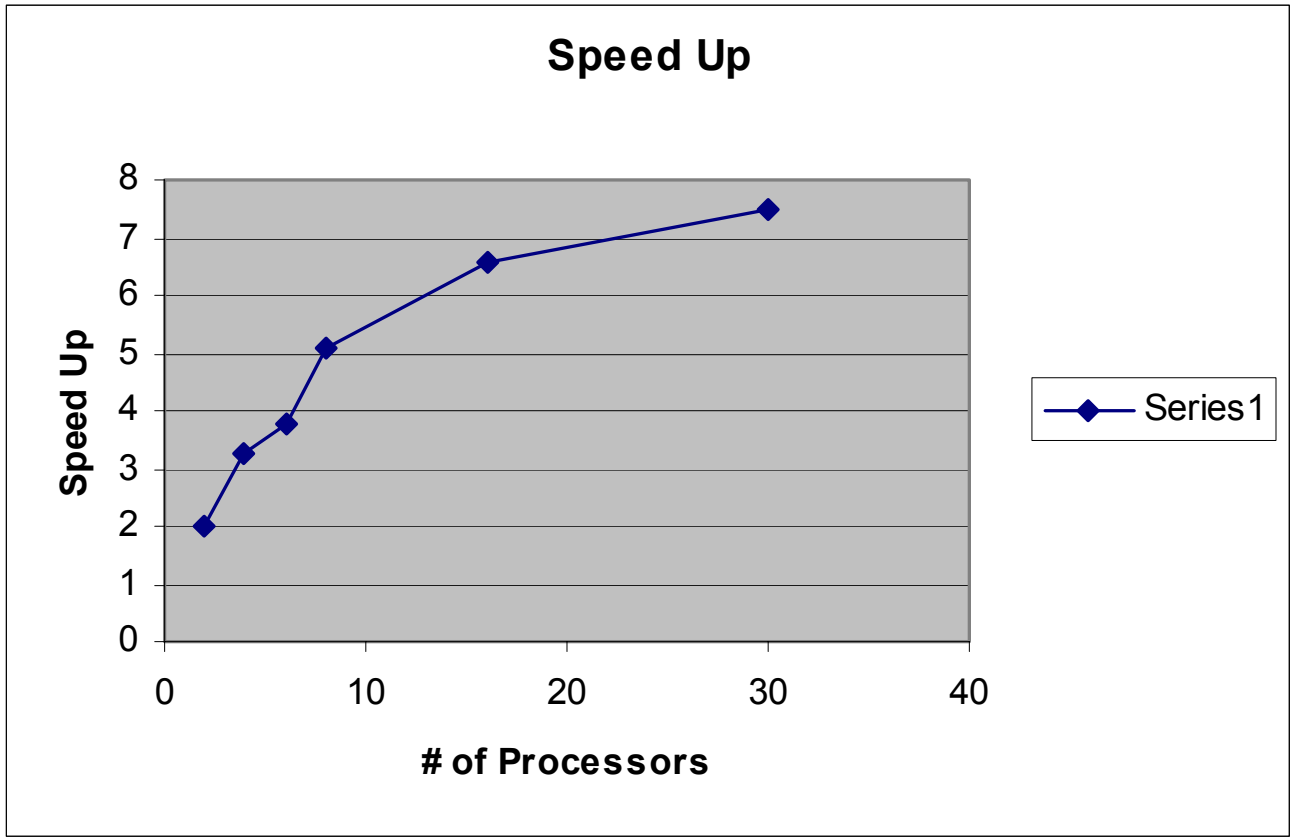
Parallel Eigensolver

- Based on Boeing's Lanczos Serial Eigensolver
  - Keeps the robust software approach
  - Complete parallel implementation
  - Distributed storage
- Capability unique to LSTC

MPP Eigensolver Performance



MPP Eigensolver Speedup



Ready for Your Testing

- MPP Implicit is ready for your testing
- Request MPP 971 AUTODOUBLE executable.