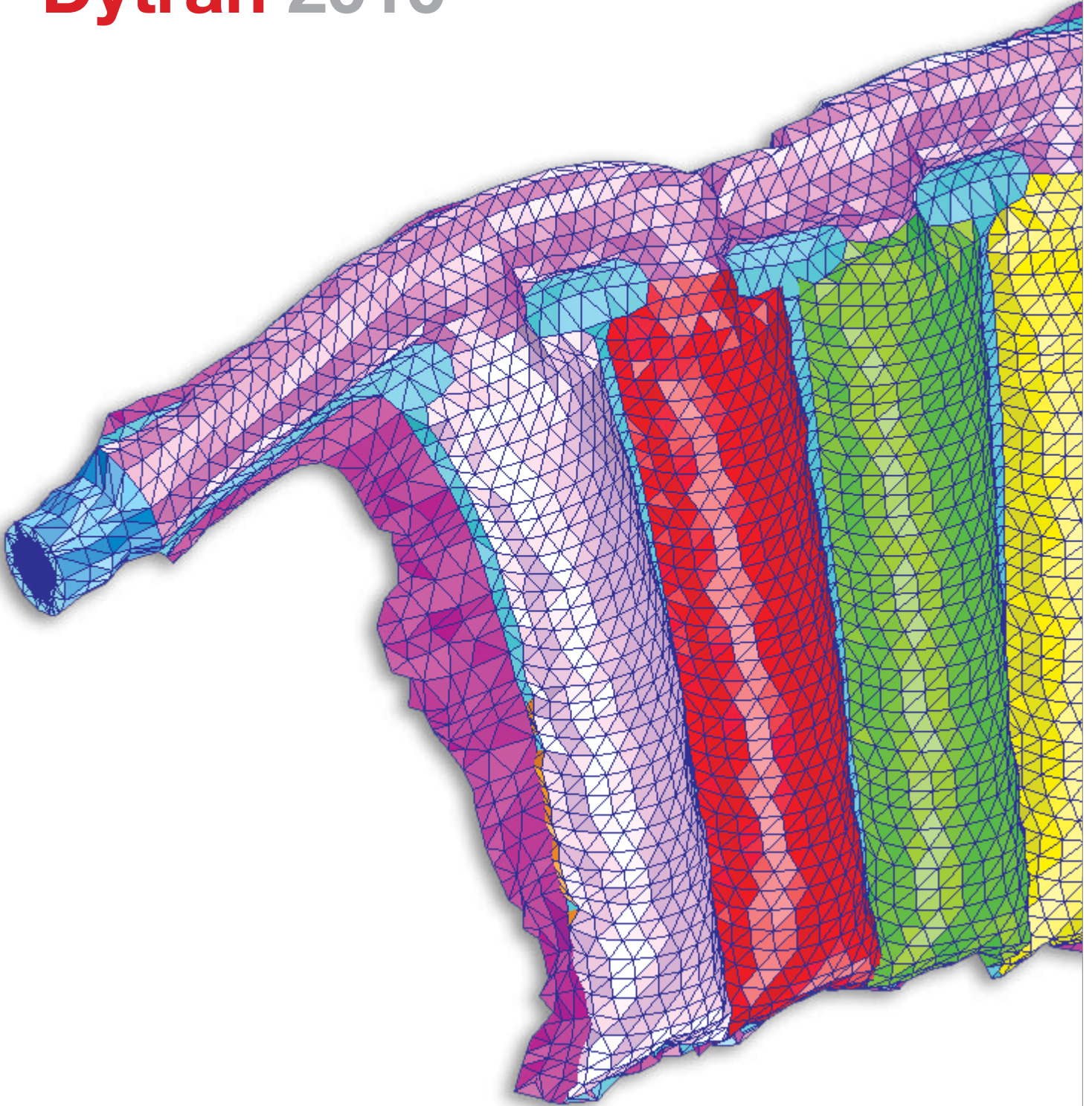


Dytran 2010



Welcome to Dytran 2010

We are pleased to bring you Dytran 2010, the latest and most comprehensive version of Dytran from MSC.Software. This new release offers significant improvements in performance for fluid structure interaction (FSI) simulations and several user efficiency enhancements that were specifically requested by Dytran users.

Performance Improvements

Dytran 2010 includes the advanced Distributed Memory Parallel (DMP) capability for Euler and coupled analyses resulting in dramatic speed improvements for CPU-intensive fluid-structure interaction (FSI) applications. The DMP capability includes:

- Single and Multi-Material Hydro Euler
- ROE Solver
- Failed Elements in coupling surfaces
- Graded Mesh
- Biased meshing
- Coupling surface output and markers
- Geometric boundary conditions
- Viscosity

There are several examples that showcase the performance improvements in this release. One example includes a ballistic impact problem modeled purely by Eulerian elements where a bullet impacts a steel plate at a high velocity. The model consisted of 90,000 Hex Eulerian elements. This model was run on Windows 64 bit and Linux 8664 systems. A speed up factor of 1.6 was obtained with 2-CPU systems. With an 8-CPU system, Windows provided a speed up factor of over 2.7 times, and the Linux system provided a speed up of over 3.7 times.

These new DMP capabilities do not require any additional licensing requirements, enabling our users take advantage of their existing hardware to improve their productivity without additional cost.

Capability Enhancements

Other enhancements include the addition of a new cyclic flow boundary condition and improved body force capability to define different materials inside a particular region. These enhancements help users solve new classes of problems.

User Efficiency Improvements

Several quality improvements have been brought forth in this release give users a more robust solution. Please review the Release Guide for more details on this new release.

Supported Hardware Platforms

Dytran 2010 is available on multiple platforms including:

- **Unix**
 - HP-UX PA- RISC 2.0, HP-UX Itanium2
 - IBM RS/6000 (Power 4)
 - Sun SPARC Solaris, Solaris X64
 - SGI R10K/12K, IRIX 64
- **Linux Itanium2**
 - Red Hat 4, Update 5, SGI Altix (SGI ProPack4 SP0)
- **Linux X8664**
 - Red Hat 4, Update 5, Linux 32 (Red Hat 4, Update 5)
- **Windows**
 - 32 bit (XP, SP2)
 - 64 bit (XP 64, SP2)

Thank you very much for your continued support of Dytran.

The MSC.Software Product team

Performance

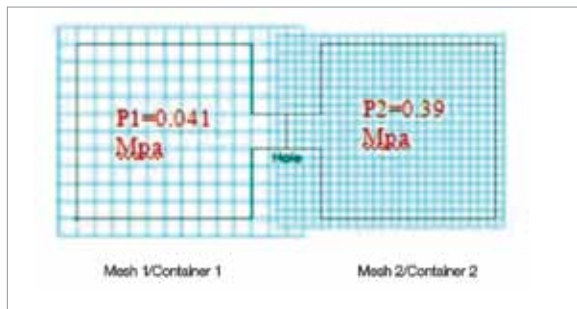
The major emphasis in the Dytran 2010 release is the improvement in the performance of its industry leading fluid-structural interaction (FSI) solver. With the introduction of the DMP technology to Eulerian solver and coupling surface computation algorithms, Dytran 2010 enables users to achieve improved productivity. Since most of the CPU time in FSI simulations is attributed to Euler and coupling surface processors, this capability enables users to see significant performance gains in complex FSI applications.

Below is a review of the various DMP capabilities supported in this release.

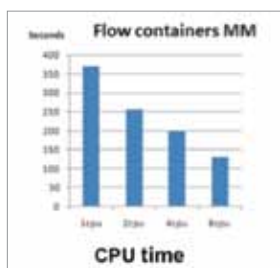
Single and Multi-Material Euler

Whether you have a single or a multi-material Euler domain, it can be partitioned to several subdomains, with each subdomain spawned to a different processor, while the structural solver is run on the master CPU. The new positions of structural grid points in each cycle are communicated with each of the other processors that send back the updated coupling surface and loads.

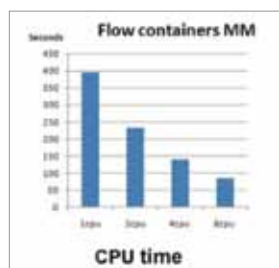
Good performance scaling is achieved in problems dominated by Euler elements. In a model of flow between two containers with 14600 Euler elements and 28 Lagrangian shell elements, speed up factors of 1.5 and 2.75 are achieved on 2 and 8 CPU Windows 64-bit systems, respectively, when compared to a single CPU run. A Linux X8664 system provided scaling factors of 1.6 and 4.5 for 2 and 8 CPU runs, respectively. While the speed up that can be achieved is problem dependent, we have noticed similar performances for problems of this type. So, users can benefit from accessible hardware without additional resource investments.



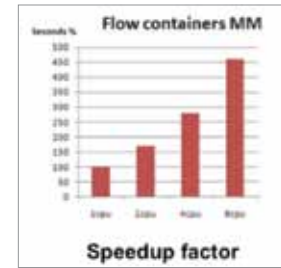
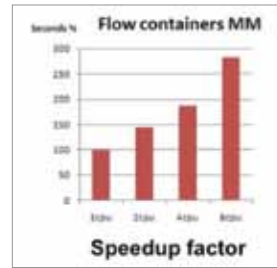
Flow between containers with multi-material solver



Windows 64



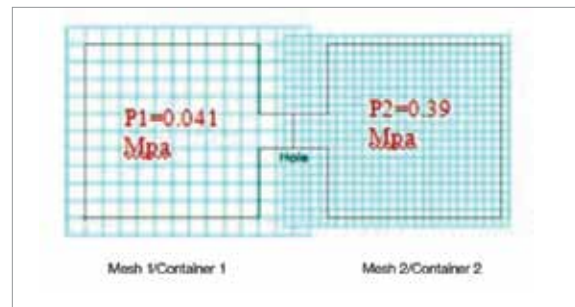
Linux X8664 OpenMPI



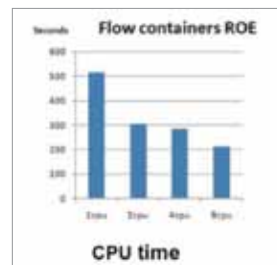
Roe Solver

The Roe solver, which is the second order Eulerian solver of Dytran is also supported in DMP mode. To update the Euler elements, the standard solvers use element values leading to first-order results. Second order results are obtained by the Roe solver using extrapolations of element values instead of element values. In DMP mode, these extrapolations can take place across multiple processors, reducing the solution time.

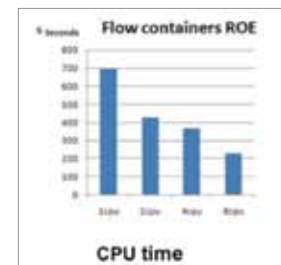
For the flow between container models, speed up factors of 1.5 and 3 are noted with Windows 65-bit 2 and 8 CPU systems, while speed up of 1.9 and 4.9 are noted for Linux 8664 2 and 8 CPU systems. Users can thus achieve similar performance enhancements with solver of their choice – Multi-material solver, Roe solver or Standard solver.



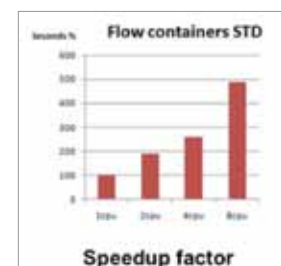
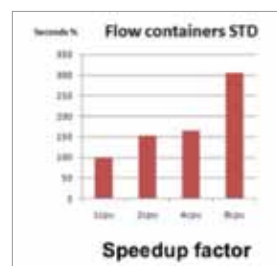
Flow between containers with the Roe solver



Windows 64

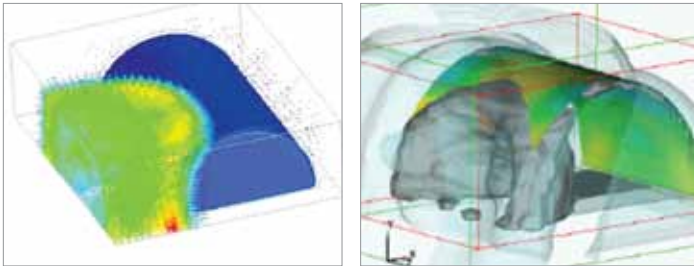


Linux X8664 OpenMPI



Flow between Coupling Surfaces

When segments of the coupling surface fail on the master CPU, this is communicated to the other processors, which in turn, create special 'porosity' faces that allow flow of material through these failed segments from one Euler domain to the other. This DMP capability is also supported where the two Euler domains are located on different processors, giving you added flexibility with your model set up.

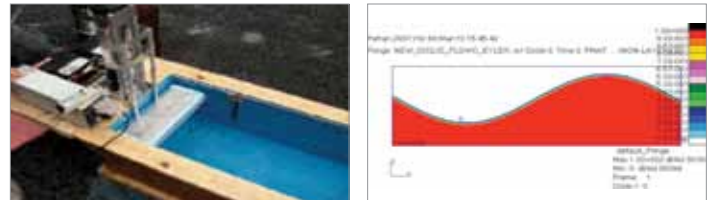


Bunker failure

Capability & User Efficiency Improvements

Cyclic Flow Boundary

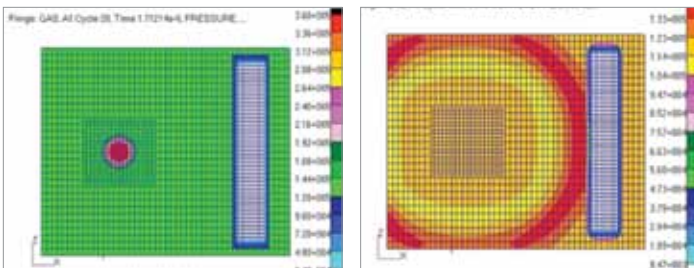
This is a common CFD-boundary condition with applications in turbine analysis, flow between rotating structures and pipe flow problems. By using the new FLOWC entry, the user can specify two boundary conditions that will form the cyclic boundary. Outflow at one boundary is used as inflow at the other boundary. With the help of this feature, users can use smaller models when possible and obtain the solutions quicker.



Water wave in a rectangular box

Graded Mesh

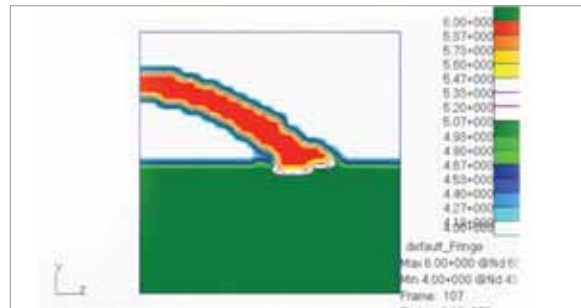
Graded meshes are composite meshes that result from gluing fine and coarse meshes together. In other words, an element of the fine mesh needs to be connected or "glued" to elements of the coarse mesh. In a DMP mode, the fine element and coarse element can be located on different processors, saving users preprocessing time.



Blast wave propagation through graded mesh

Body Force on Distinct Regions

The body forces can now be defined for different materials inside a particular region. The regions can be defined by a box, sphere, cylinder or a surface. One important feature is that this can be used to define a magnetic field where the material will move together when a gravity or acceleration field is applied, with applications that include copiers and toners, opening up new possibilities in multi-fluid simulations.

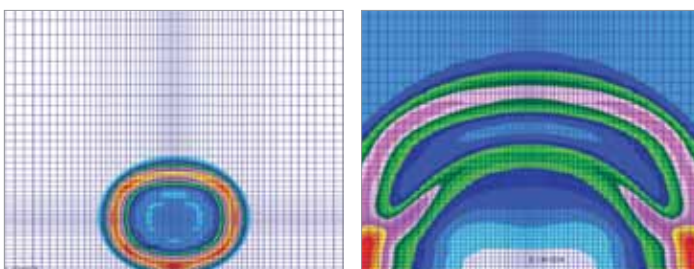


Water hit by magnetic particle jet

Additional Extensions

In addition to the above, the DMP capability is also extended to support a number of useful features including:

- Biased meshing
- Coupling surface output and markers
- Geometric boundary conditions, and
- Viscosity



Blast wave propagation through biased mesh

Dytran – Solver of Choice for FSI

With your continued support, MSC.Software remains committed to enhancing our explicit nonlinear solutions, Dytran and MD Nastran SOL700.

Performance

Since performance is one of the major challenges faced by our customers while solving CPU intensive FSI problems, we have addressed this issue by introducing DMP technology in this release.

User Efficiency

Several quality improvements have been introduced in this release. With further releases, we will continue to improve the user experience for our customers.

Thank You

MSC.Software appreciates the confidence and trust that you, our customers, have placed in our products throughout the past years. This is also demonstrated by the customizations of the product and level of integration of our products into your CAE processes. You will continue to see more advances going into the product and we, as always, are pleased to have you as a customer and partner.

Corporate

MSC Software Corporation
2 MacArthur Place
Santa Ana, California 92707
Telephone 714.540.8900
www.mscsoftware.com

Europe, Middle East, Africa

MSC Software GmbH
Am Moosfeld 13
81829 Munich, Germany
Telephone 49.89.431.98.70

Asia-Pacific

MSC Software Japan LTD.
Shinjuku First West 8F
23-7 Nishi Shinjuku
1-Chome, Shinjuku-Ku
Tokyo, Japan 160-0023
Telephone 81.3.6911.1200

Asia-Pacific

MSC Software (S) Pte. Ltd.
100 Beach Road
#16-05 Shaw Tower
Singapore 189702
Telephone 65.6272.0082



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