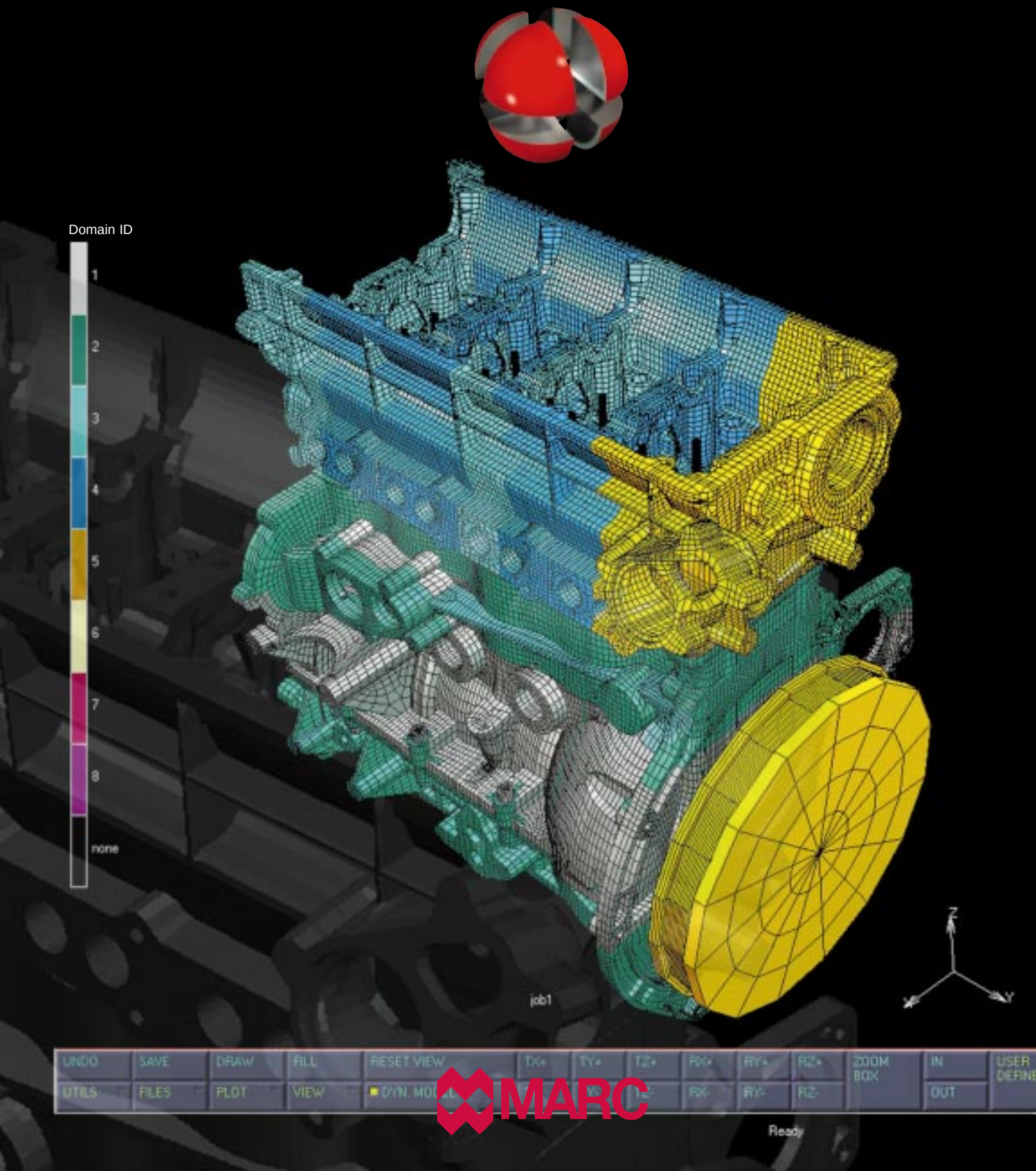
MARC

The power of parallel processing unleashed.



Unleashing the Power of Parallel Processing.

Domain Decomposition — The Critical Difference

To deliver the full power of parallel processing to users, MARC breaks through two traditional barriers. The first is that most algorithms can derive only limited benefits from the use of multiple CPUs. The second is Amdahl's Law, which states that a portion of an algorithm can't be parallelized to make a significant impact on the total clock time.

MARC parallel processing technology uses Domain Decomposition (DDM) to solve large and complex engineering simulations faster. Where other FEA software only perform parallel processing for parts of a large problem, MARC achieves superlinear scaling by implementing parallelization at every level of the solution. Because analyses are completed in a fraction of the time, you're able to investigate problems more thoroughly and gain a greater understanding of how components will behave in their real-world operational environment.

Let MARC Do the Work

Mentat, the MARC graphical user interface, can automatically split a large problem into domains that are optimized for speed and accuracy, while minimizing inter-domain communication, which is achieved through the message-passing interface (MPI). Once the model is subdivided into domains, the entire FEA process is performed in parallel. First, each domain is read into MARC in parallel. Then the stiffness and mass matrixes are assembled and solved separately. Even the potentially time-consuming output procedures are performed in parallel. This allows you to solve not just big problems, but complex problems faster and more completely. The resulting time and cost savings represent an enormous competitive advantage.

Just Choose the Number of CPUs

To achieve numerical accuracy and speedy solution time, the MARC contact and friction algorithms automatically restructure large, complex problems for efficient delegation across multiple CPUs. The user simply defines the model by constructing or importing the model from a CAD system using Mentat. The simulation is defined and the analysis is ready to begin. The user decides on the number of CPUs to be involved in the calculation, then Mentat automatically or interactively subdivides the model into as many domains as there are CPUs. The analysis is then submitted and monitored automatically. The graphical results can be viewed either in any domain or in the entire model.

Affordable Supercomputer Power

MARC parallel processing technology gives you the ability to perform the largest most complex simulations imaginable with no hardware limitations, while reducing the cost.

MARC lets you...

- Optimize existing network computing capabilities by clustering workstations
- Distribute large workloads across multiple CPUs with superlinear scalable speeds

With MARC, users can rely on existing network computing capabilities,which results in cost-savings and enables data management of large problems. Engineers can create more complex designs and perform more trials on increasingly large problems. When needed, more power can be obtained simply by adding more CPUs.

Save Time and Money

Using economical and scalable MARC parallel processing technology on multiprocessor workstations, problems that simply couldn't be analyzed before can be now, and problems that could only be solved overnight are now solved within a few hours. Engineers can analyze structures, rather than just components. Users can really see how individual components work in the real-world, rather than relying on assumptions. And they can do it while enjoying the added benefit of much lower purchase and operating costs compared to supercomputers.

Analysis the way you've always wanted it is available today from MARC.

MARC. The power of parallel processing unleashed.

Analysis the way you've always wanted it.

Analyze Structures, Not Just Components

Imagine being able to analyze the way an individual component would work within its real-world operational environment. MARC makes that dream a reality. Using MARC, you don't have to make assumptions about a structure in order to analyze a component, you can simply analyze the entire structure.

MARC...

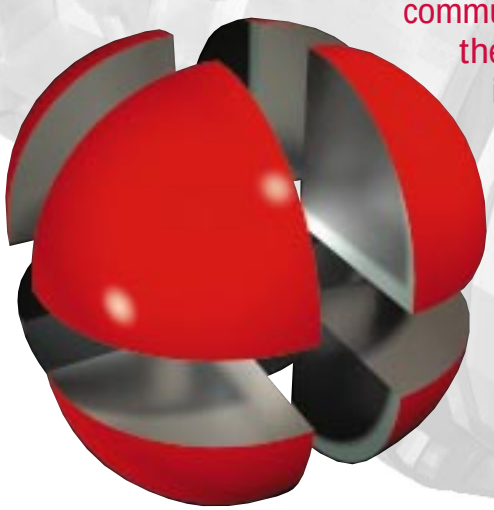
- Brings the benefits of parallel processing to the analysis of structures
- Solves large, complex problems in a fraction of the time
- Enables you to investigate problems more thoroughly
- Makes Virtual Manufacturing a reality

Breakthrough Technology

MARC is breakthrough parallel processing technology that lets you capitalize on the growth of chip performance, and the potential performance benefits of multiple chips. Compared to supercomputers, MARC delivers comparable or better performance and infinite scalability at a much lower purchase and operating cost.

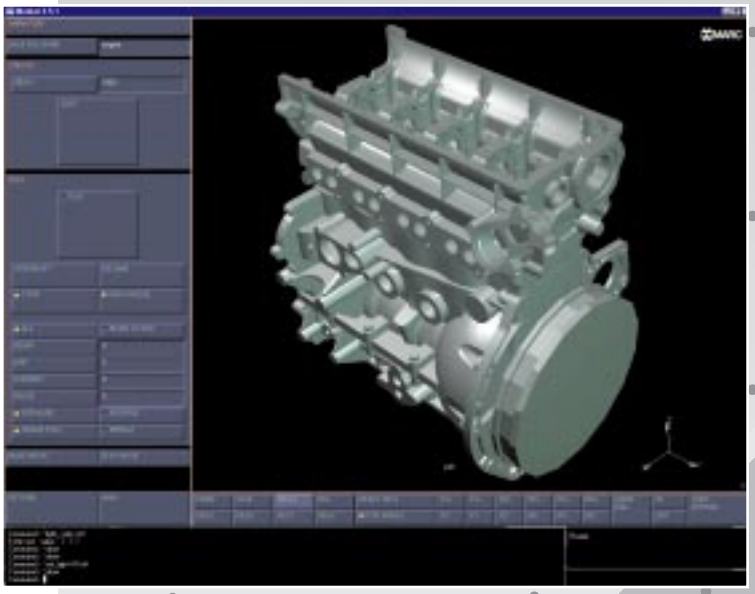
MARC...

- Implements parallelization in the entire FEA process to achieve superlinear scalability
- Automatically splits a large problem into domains for optimum speed and accuracy while minimizing inter-domain communication through the message-passing interface (MPI)
- Enables you to solve not just big problems, but complex problems faster and more completely



Diesel Engine

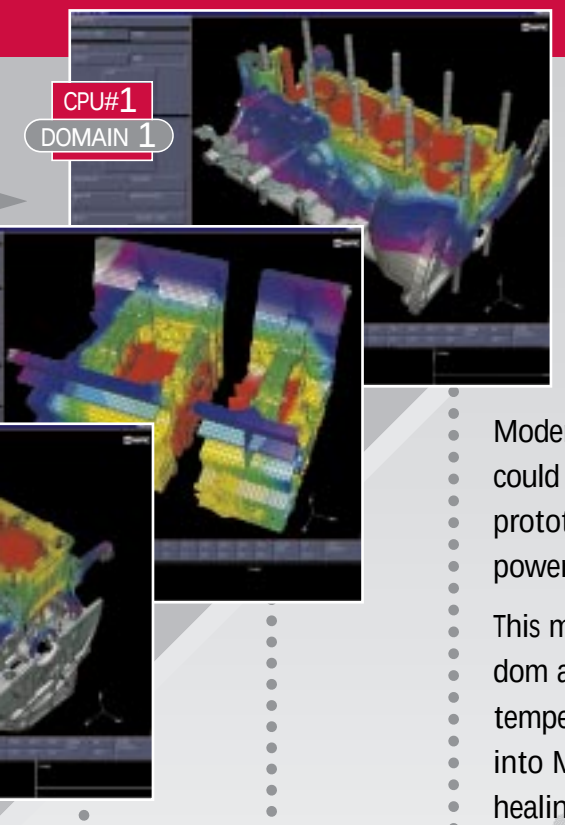
1 Choose the number of CPUs and submit the model to MARC for anlaysis.



2 MARC applies parallelization to the entire FEA process.

3 View the graphical results in any domain, or in the entire model.

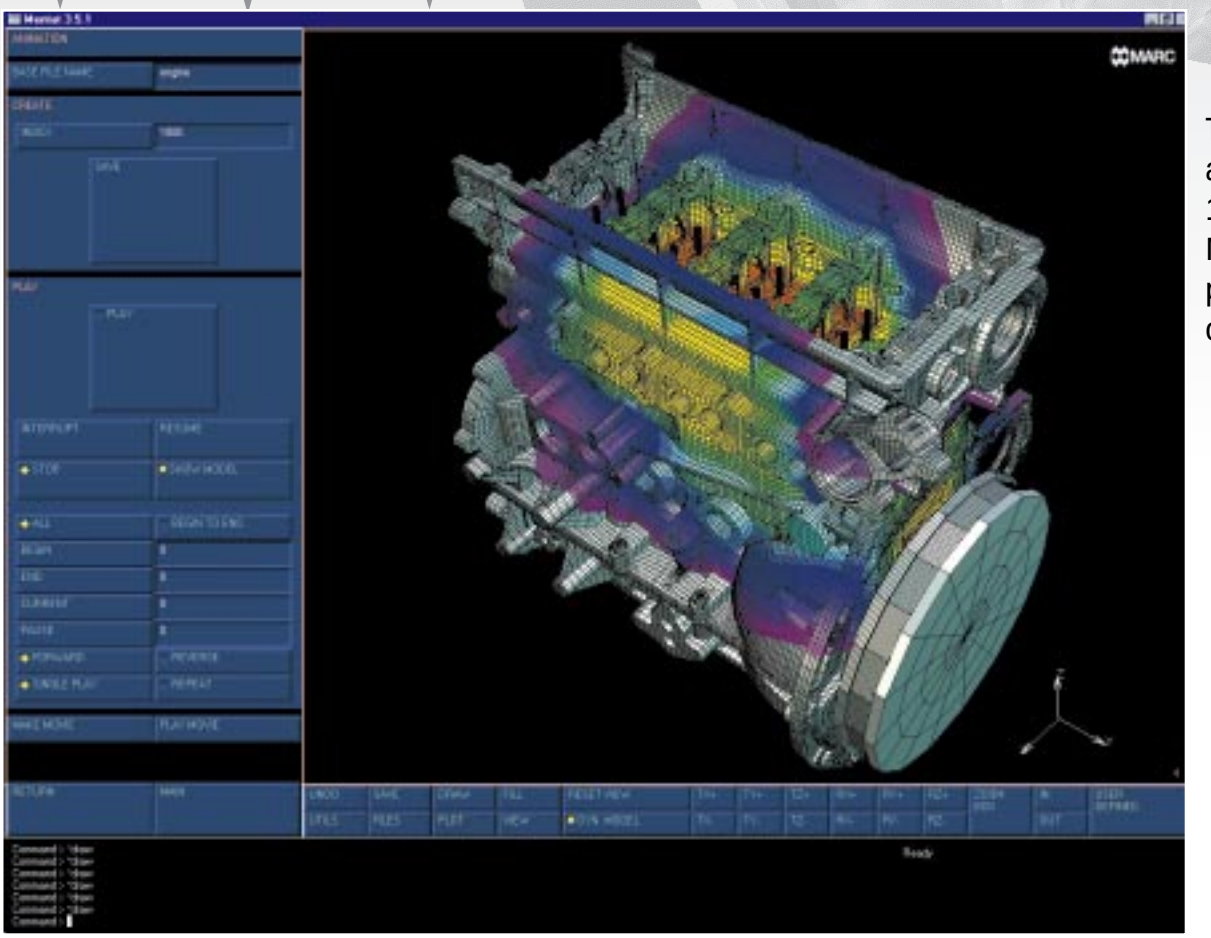
Diesel engine model courtesy of Adapco.



Investigate models more thoroughly to gain a greater understanding of their real-world behavior.

Modern diesel engines, cleaner and more fuel-efficient than their predecessors, could soon be used in domestic sports-utility vehicles. The Ford Diata is a prototypical small compression-ignition, direct-injection aluminum engine to power a future ultrahigh-mileage hybrid vehicle.

This model involved 448,361 elements and nearly 1.8 million degrees of freedom and was analyzed to determine the transient thermal response to a high temperature heat source applied within the cylinders. The data were imported into MARC, and inside-out elements were repaired using automated geometry healing capabilities in Mentat. A 10-increment analysis was first performed on a single processor and required 78 minutes for completion. Mentat's degenerate option was then used to decompose the model into eight domains.



This model was analyzed in just 12 minutes using MARC parallel processing technology on eight CPUs.

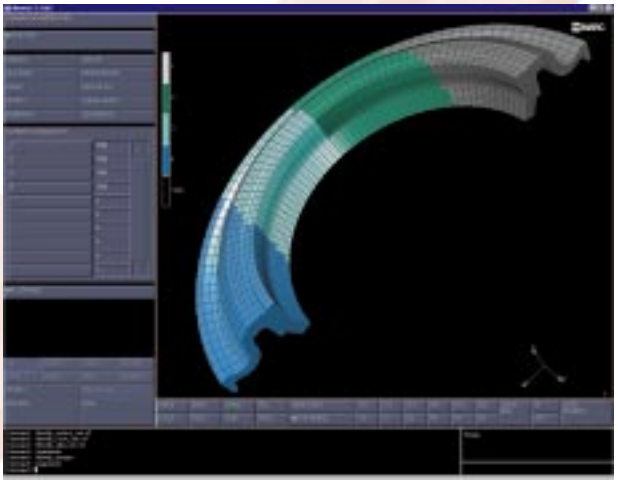
Crossbar Pin Seal

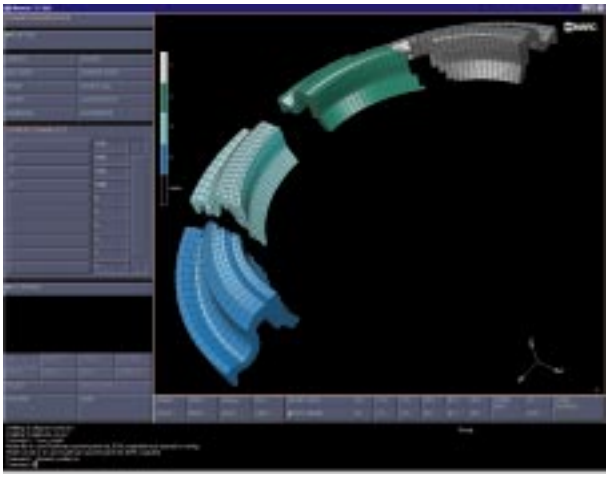
Analyze problems you just couldn't analyze before.

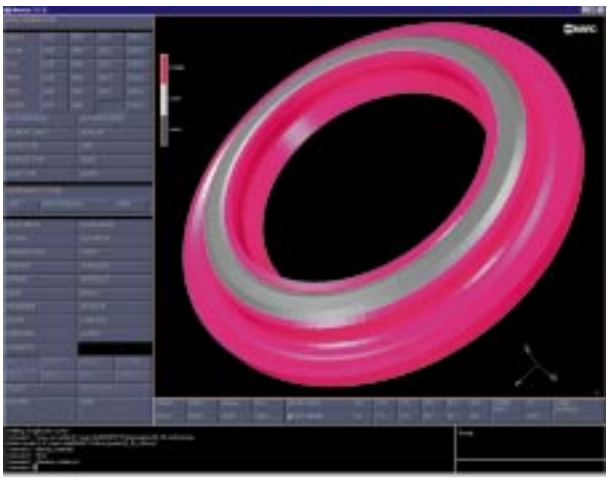
This crossbar pin seal is used to protect grease in a crossbar mechanism in a track-driven vehicle. A metal can is molded into the urethane seal to keep the seal centered on a pin. When the pin pivots, the seal is no longer axisymmetric. The model was analyzed using MARC parallel processing technology to determine the radial sealing force at the maximum radial pin deflection.

"This was a time and size issue. We weren't just analyzing a 3D model, but a model consisting of two materials: urethane and metal. I made a three-dimensional model and ran the problem on my single-processor system. There were 46 increments in the analysis and it took 24 hours to run one of the increments. My system just wasn't powerful enough to solve it and solve it in a timely manner. I asked MARC for assistance. They ran it on four processors and the entire analysis only took 4.3 hours. The results verified for us that the design was going to work in customer applications."

Eric R. Anderson
Design Engineer
Parker Packing Division
Parker Seal Group
Parker Hannifin Corporation







Crossbar pin seal model courtesy of Parker Packing Division,
Parker Seal Group,
Parker Hannifin Corporation.

We look forward to hearing from you.
For more information, visit our Web site at:
www.marc.com.

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