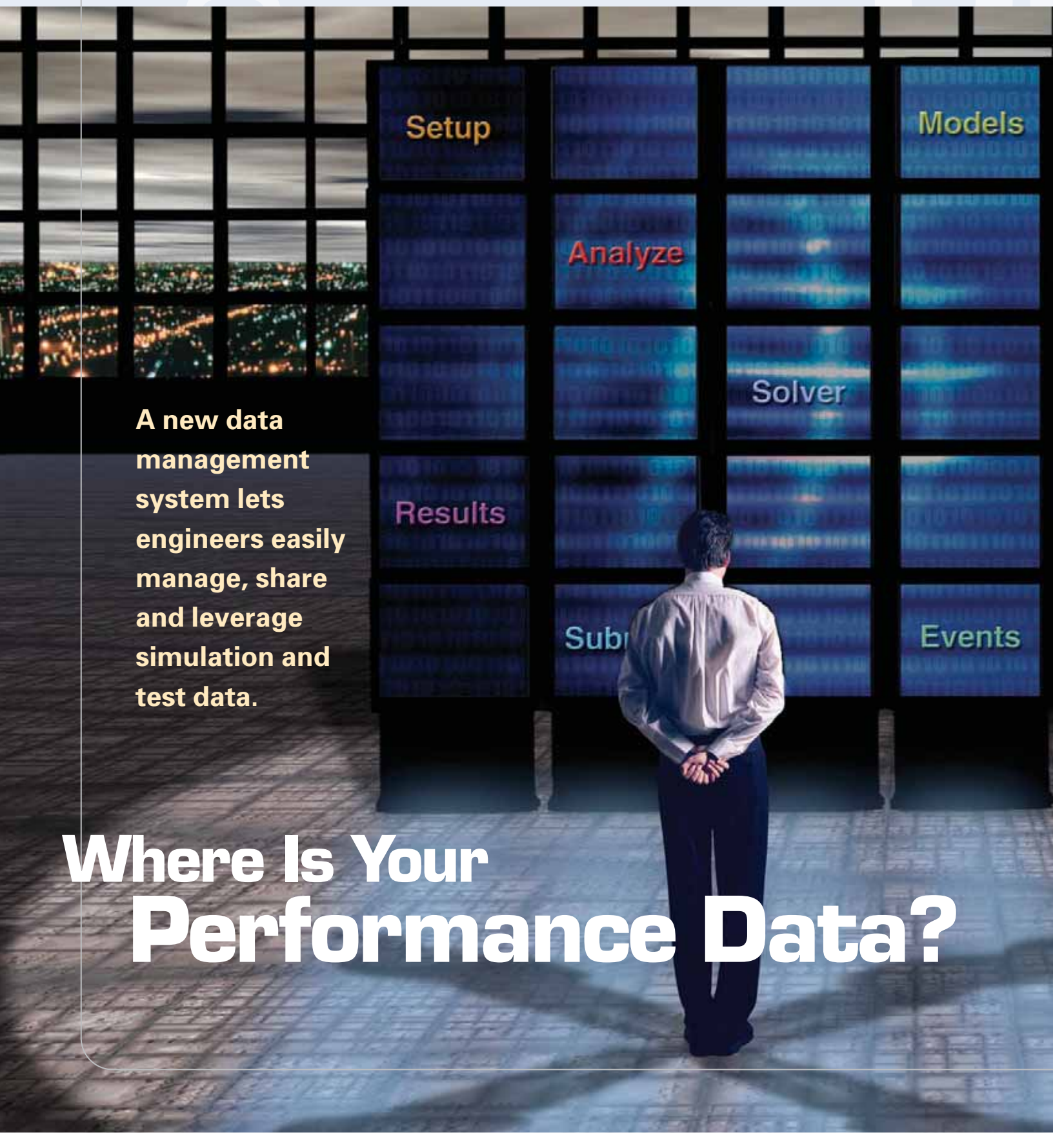
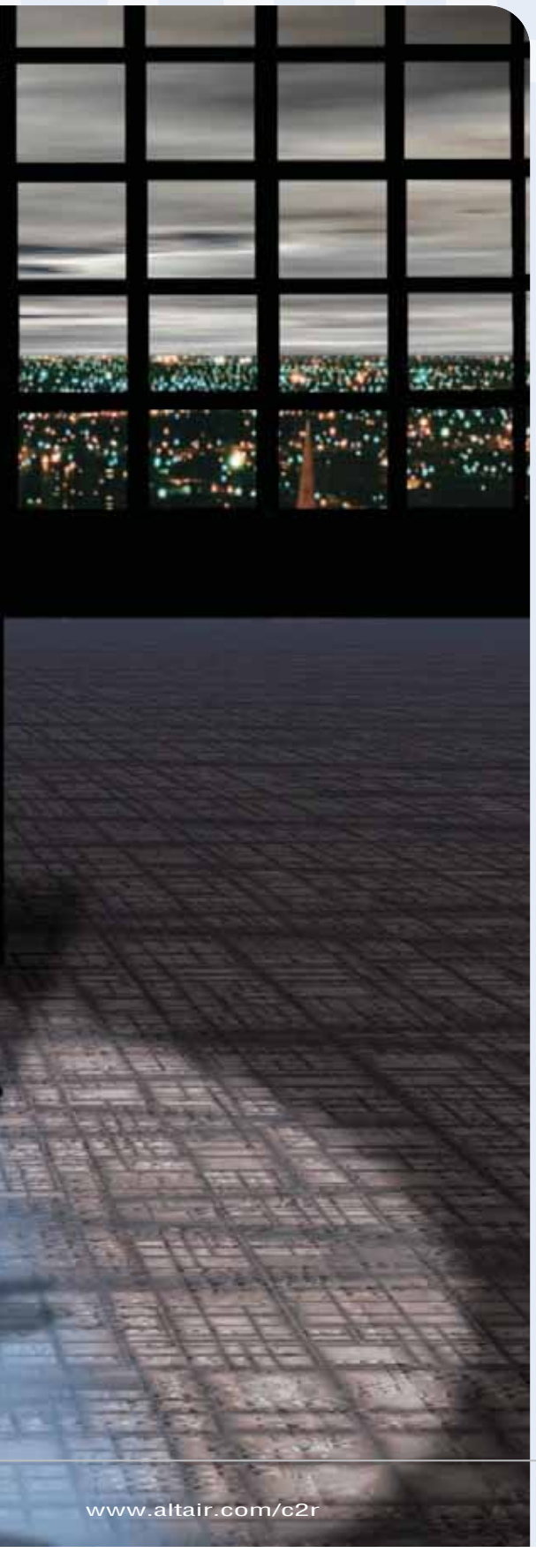


A new data management system lets engineers easily manage, share and leverage simulation and test data.

Where Is Your Performance Data?



by **Alhad Joshi**

Unmanaged and uncontrolled performance data has major ramifications at the enterprise level. The main issue is the intrinsic inability of upper management to respond to noncompliant product design as might be evidenced from analyses and tests, especially during early development phases.

The data is there, somewhere, but without organization and tracking at the end-user and enterprise levels, it becomes extremely difficult to identify problems and issues in a timely fashion. This can result in costly delays and increased time to market for compliant products.

Today, engineers and analysts can employ automated data management solutions uniquely tailored to their work processes and environments, allowing for more informed decision-making at the enterprise level. Easily implemented within existing product data management (PDM) and enterprise resource planning (ERP) deployments, these flexible and nonintrusive solutions make it easy for engineers and analysts to manage, share and leverage engineering simulation and test data for various stakeholders throughout the organization.

The Product Development Path

Product development is a highly iterative process from concept to manufacturing. Functional groups that span marketing, design, engineering, manufacturing and purchasing play a role in getting a new or derivative product to market. Ensuring that all groups have access to the latest performance data, both from computer-aided engineering (CAE) and physical tests, is always a challenge. PDM and ERP systems support core design and manufacturing activities but provide little support for CAE or test data.

The basic engineering function is to optimize and certify product performance. CAE substantially reduces the need to physically test each design iteration. As manufacturers rely on CAE for product performance validations, product optimization and

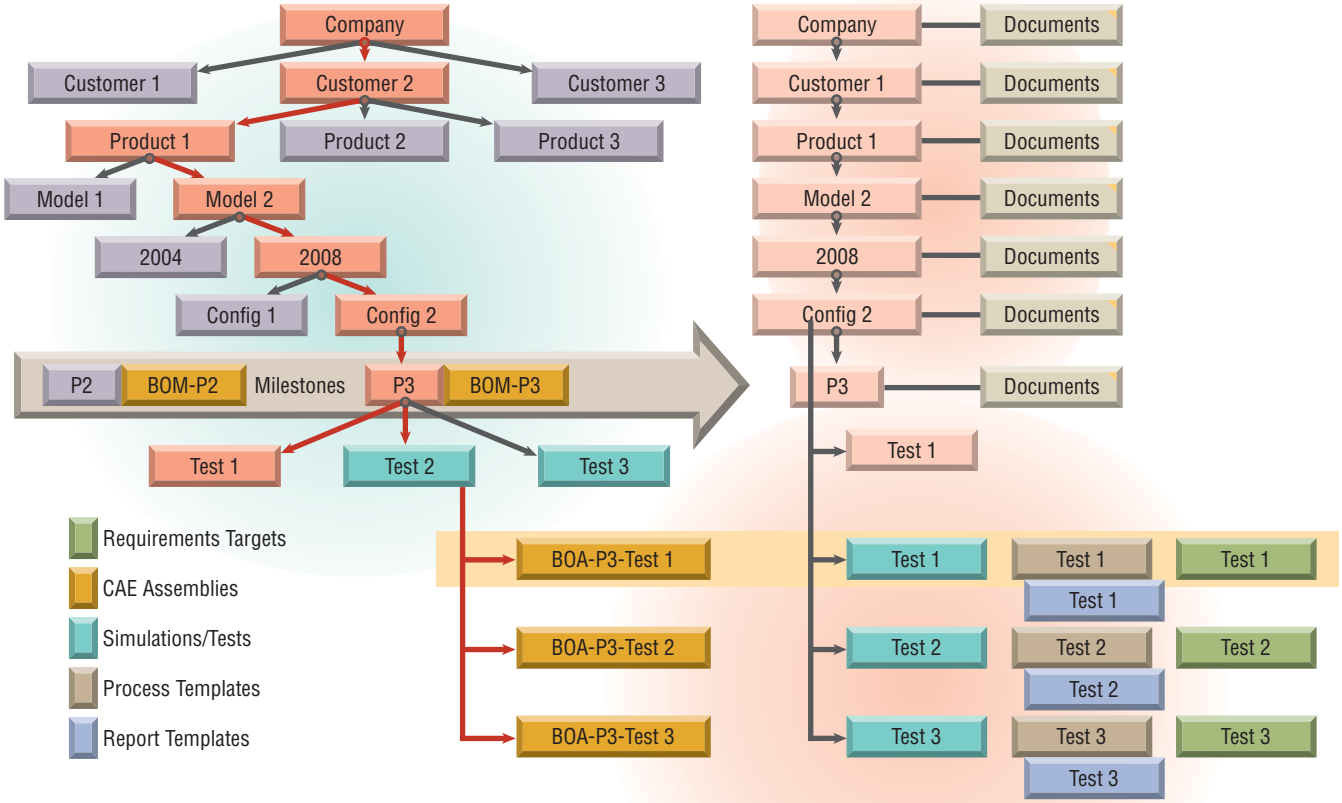


Fig. 1. ADM allows performance data management using a configurable structure that can provide product requirement fulfillment status views to enable rapid decision-making.

reduction of warranty claims, the number of CAE analyses performed has skyrocketed. New market trends are driving the need to locate and leverage performance data as efficiently as possible. These include an increasing reliance on and number of analyses performed, geographically dispersed engineering teams, highly customized consumer product offerings and variants, and the need to keep CAE activities in sync with product development.

The principal objective of the data management system that handles performance metrics from CAE and tests is to enable rapid decision-making at various levels of management by providing role-specific views of performance assessment. These so-called "dashboards" show the status of analyses and/or physical tests at each product development milestone, accompanied by reports ranging from pass/fail to specific comparisons with product performance engineering targets derived from product requirements (Fig. 1).

Despite the growing importance and value of performance data, this information tends to reside on isolated islands throughout the organization, with few bridges to product development systems. Nevertheless, it is possible to build a nimble and well-organized engineering environment through the judicious use of customizable and scalable software systems tailored for supporting engineering activities.

Defining Data Management

Before exploring ways to manage performance data, it is important to understand exactly what data management entails.

Most users are very familiar with organizing files on the file system in folders and subfolders. Files have properties. Files organized in folders represent "parent-child" relationships, and file properties provide information about files without having to open the file in an application.

Data files needed in multiple directories are copied to the required directories, creating duplicates. The two main problems with this kind of organization are excessive file duplication and creation of multiple versions of the same file. The concept of a Master File is usually lost in this process. In addition, file access to the product development team remains a concern.

Building a logical structure that allows users to categorize and associate files in any desired way — and provide views based on relationships without having to physically locate files in directory structures — is a preferred approach. There are a number of commercial electronic data management systems that manage files in vaults (or server-based directories) and store the file properties in a relational database, providing just such functionality.

Such systems enable fine-grained access control, provide extensive search capabilities using "properties" (also referred to as meta-data), enable storage of arbitrary data packets and offer a customizable data model. What's more, they present an infrastructure that allows for a large group of users to access data from a common source. These systems also offer workflow modules that control the creation and release of data.

While it is possible to extend the traditional PDM systems to handle specific engineering requirements, many challenges exist:

• **Complexity.** PDM systems cater to CAD data

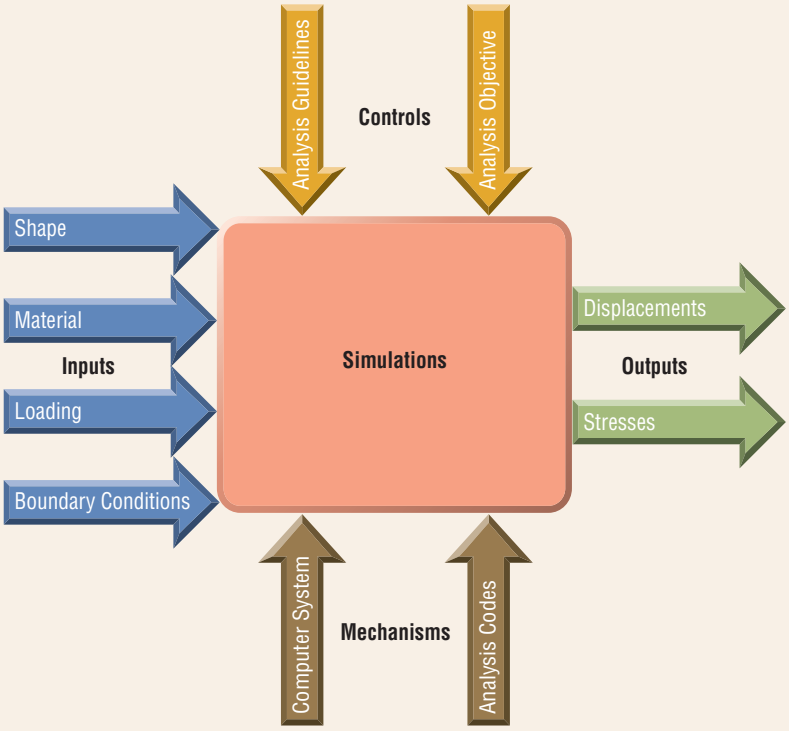


Fig. 2. Every simulation has data Inputs, Outputs, Controls and Mechanisms.

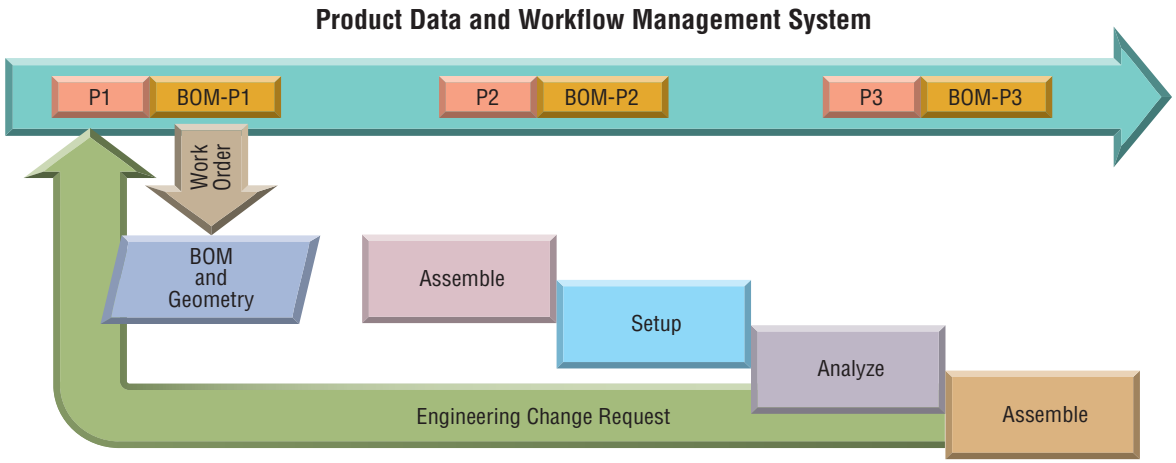


Fig. 3. In the product development process, change recommendations need to be managed carefully in order to avoid contradictory change recommendations for single parts.

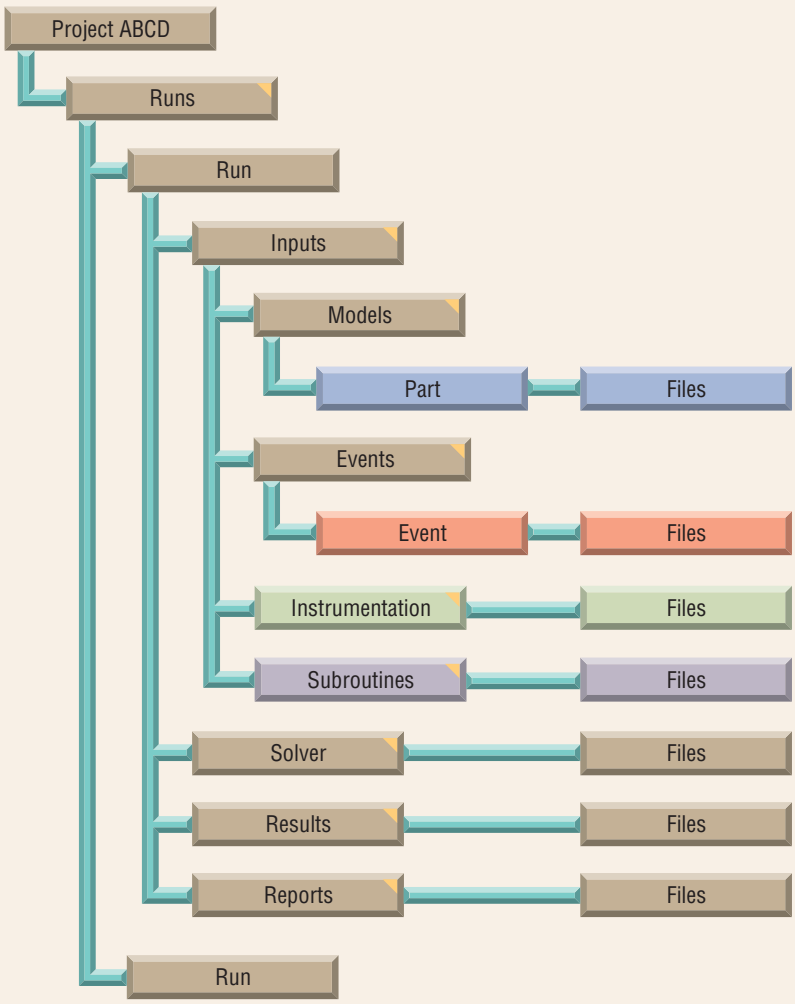


Fig. 4. CAE analyses often include multiple runs.

and configuration management as well as product release workflow. CAE and testing demand a more complex data organization that needs to be specially modeled in these systems.

- **Implementation effort.** Unless there are standardized data models that are leveraged in a wide customer base, custom implementations can be extensive and expensive.
- **Data retention and performance data shelf life.** Product data is typically stored and managed throughout the lifecycle of the product. Engineering data, on the other hand, typically has a much shorter shelf life. Further, CAE analyses produce huge amounts of data, of which a small subset needs to be stored for building knowledge. This is especially true with large result data sets that can be reproduced if required at a later time. Once the essential knowledge is captured, it is not always necessary to retain CAE data for any length of time, unless such data retention is regulated by law.

Challenges Unique in the CAE Environment

CAE teams face several data management issues. First, most data movement operations are performed manually by analysts. In fact, some analysts develop their own scripts to automate functions. These utilities tend to remain local and are used only by the analyst who developed them.

Second, there is little standardization of analysis methods. Companies develop best-practice documents that analysts are required to follow, but the actual execution is left to the analysts.

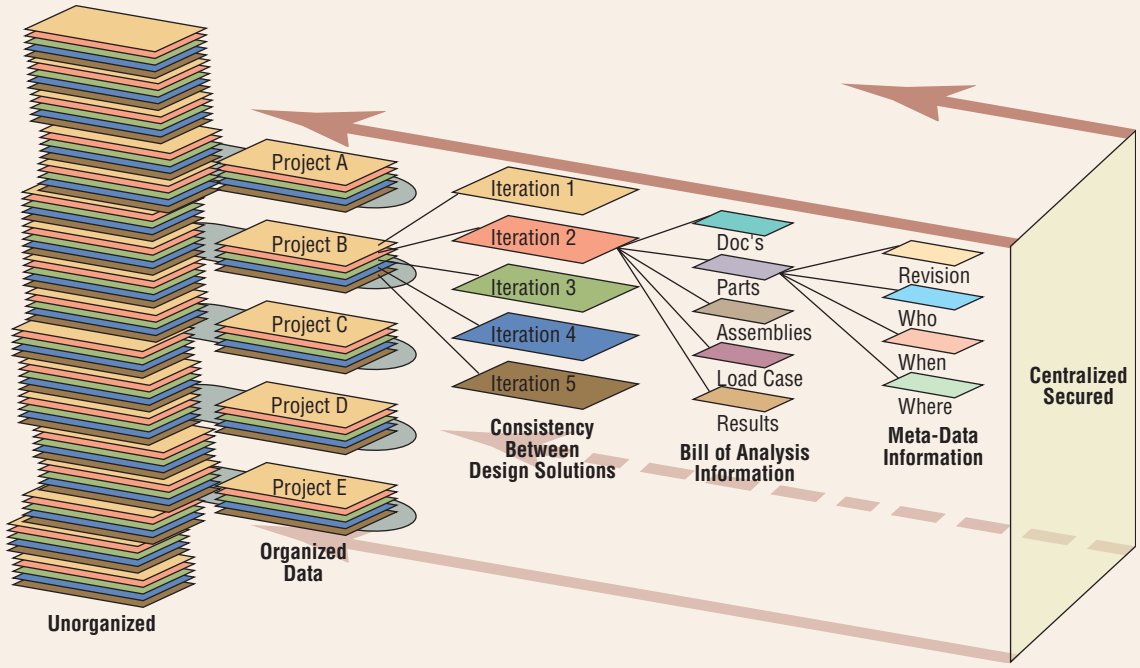
Third, methods development is a scientific process and needs to be thoroughly and painstakingly documented in order to arrive at reliable conclusions. In a traditional environment, methods developers need to be highly disciplined in order to establish best practices for various analyses.

CAE Data Specifics

Any CAE simulation can be represented by specific activities (Fig. 2). Every simulation has data Inputs, Outputs, Controls and Mechanisms. When you think about CAE data, it is important to not only consider Inputs and Outputs but also the data associated with Controls and Mechanisms. All the data must be managed.

Inputs typically refer to engineering requirements, targets and objectives; geometry and constraints; welds and joints; loads; materials; physical test data; and manufacturing data. Data can be stored in ERP or PDM systems as well as in materials and testing system databases.

Outputs can be defined as results and reports in addition to change recommendations. Controls refer to the process guidelines and process/report templates while Mechanisms represent the computing infra-



In data management, analysts must manage, share and control a wealth of engineering simulation and test data for multiple projects. Often, CAE activities tend to reside on islands with few bridges to product development systems.

structure information and analysis codes used in the process. This data often resides in *ad hoc* systems.

In the context of product validations, CAE-driving design and CAE that supports warranty services, the CAE subsystem operation is the same for all activities (Fig. 3). It initially includes creating a bill of material (BOM) and geometry. Other steps in the process are performing assembly, setup, execution and assessing results. If problems with performance are uncovered in the analysis stage, engineering change requests (ECRs) for parts are filed, and the process continues.

Analysts repeat this operation thousands of times, using a variety of input data and generating results and reports orders of magnitude larger than ever before. With the advent of robust design practices, the thousands of data files they generate annually will likely rise to the tens of thousands. A simple task of using the right input deck and corresponding solver results can become an issue, and worse yet, can lead to errors in results assessment and change recommendations.

Change recommendations, in fact, need to be managed carefully in order to avoid contradictory change recommendations for single parts. A part that fails in one analysis could be deemed acceptable or even optimum based on findings from different analyses.

Change recommendations need to be reconciled and made consistent before creating an ECR. Unless CAE data from different analysis disciplines is easily accessible to the whole team, making consistent change requests might not be possible. As a result, conflicting change requests for the same part might add to delays in product release and time to market, warranty claims or, in the worst case, product recalls.

Managing Simulation Data

Data organization (Fig. 4) includes support for managing various iterations within a simulation. Iterations represent different "what-if" analyses. Each simulation has properties such as Purpose, Product Line, Customer, etc.

A different data organization is required to support

MAGNA STEYR Selects Altair Engineering as Strategic Partner for CAE Data Management

MAGNA STEYR, a global automotive engineering and manufacturing company, and Altair Engineering have formed a strategic partnership for CAE data management. The management of data that accumulates during the numeric simulation and analysis of components and product groups represents a constantly increasing challenge for future product development. While in the geometry data (computer-aided design) sector, the use of product data management (PDM) systems corresponds to the state of current technology. This topic is one of the greatest tasks for simulation in the future. CAE is becoming a driving force in the product development process, and the number of variants and case studies to be simulated is increasing significantly. The resulting data must also be managed continuously and efficiently with respect to distributed development environments.

As part of this agreement, Altair Data Manager (ADM) software will be developed further to address MAGNA STEYR requirements. Development will focus on both the actual data management and the incorporation of this data management into existing and newly created, automated CAE processes. An important component in these efforts is the integration between ADM and the existing software environment.

"We sought out Altair as our strategic partner for this topic after an intensive evaluation phase. With its existing solutions and product development, Altair was able to demonstrate a clear CAE data management strategy that was compatible with MAGNA STEYR," reports Helmut Ritter, department director of information management and PLM director at MAGNA STEYR FAHRZEUGTECHNIK.

Altair Data Manager product advancements resulting from this partnership will be made available to Altair HyperWorks clients in future commercial releases. To review the full news release, please visit our Press Room at *www.altair.com*.

To receive Altair Data Manager product information, visit *www.altair.com/c2r* or check 06 on the reply card.

the management of CAE assemblies. These typically are subsets of the as-designed CAD assemblies and also include data needed for CAE analyses that is not a part of the manufactured product (such as test fixtures, anthropomorphic dummies, pendulums, barriers, etc.). Once such assemblies are built, they can be used for setting up a variety of simulations by end-analysts.

CAE assemblies are built and tuned for different analysis types. This tuning includes using different mesh densities, employing lumped masses and inertia properties for certain parts, suppressing parts that are deemed not important for that analysis, etc.

To address the needs of CAE analysts, performance data management solutions should:

- Provide a standards-based compliant data model that enables compatibility with third-party PDM solutions;
- Deliver consistency between as-analyzed and as-tested product assemblies, which improves product quality and lowers development costs;
- Provide a foundation to build and deploy data management best practices for CAE and test activities;
- Enable CAE analysts to manage, organize and control their CAE processes and data using a common, simplified data model;
- Allow analysts to work with up-to-date data and track all inputs, outputs and CAE iterations in the context of a product development milestone;
- Store data in a central location to provide access to the product development team;
- Maintain an audit trail, without increasing the end-user's effort;
- Build live connectors with the product development system to allow BOM and CAD extraction;
- Enable part change notifications and generate ECRs for parts stipulated by test or CAE analysis; and
- Allow end-users to efficiently mine and better utilize this data on current and forward programs.

As a result, design and engineering teams can provide faster design turnaround, quickly perform trade-off studies, and improve the level of correlation between test and analytical results, further reducing the resources and time to physically validate new products. In addition, performance data management solutions can provide a means with which to create dashboard reports throughout the product lifecycle that are uniquely tailored to the needs of individual stakeholders — from end-users to management and executive level. Above all, finding a solution to leverage and share performance data can provide the critical, timely information that decision-makers across the enterprise need to positively impact the success of the business. C2R

Alhad Joshi is Director of Enterprise Software Consulting, Altair Engineering Inc.

To receive more information about Altair data management solutions, visit *www.altair.com/c2r* or check 06 on the reply card.