

# Altair Enables Up-Front Multi-Disciplinary Systems Development and Design Optimization

## CIMdata Commentary

### Key takeaways:

- *Up-front performance analysis and optimization, starting early in the product development cycle, requires both a systems view of the product and simulation and co-simulation models of varying degrees of fidelity.*
- *Leading thinkers are turning away from the creation of CAD geometry as “the design starting point” to an up-front engineering process that focuses on optimizing product functional capability versus requirements before committing to design decisions that lead to detailed 3D assembly and component design.*
- *Altair is rapidly rounding out its systems modeling and simulation portfolio, through internal application development, acquisitions, and partnerships, to enable this vision of model-based and simulation-driven design.*
- *Tightly integrated optimization capability is a key factor in this vision, as is enabling early exploration of system-level designs across multiple disciplines.*

With the relentless improvements in engineering software and computer capability, simulation can now be effectively applied well ahead of detailed component design. As Mr. Jim Scapa, CEO of Altair says, “CAD is not really [used as] a conceptual design tool.” There are many who agree with this sentiment, and who believe that the early focus on detailed CAD geometry of the past two decades has caused serious dislocations in the process of engineering new products. The time has come to return to the maxim of “form follows function.” The problem with the CAD-centric development process is that it starts with 3D geometry and then endeavors to assess its validity as a solution to the problem at hand. “No, development does not start with geometry,” says Dr. Michael Hoffmann, Senior Vice President, Math and Systems, at Altair.

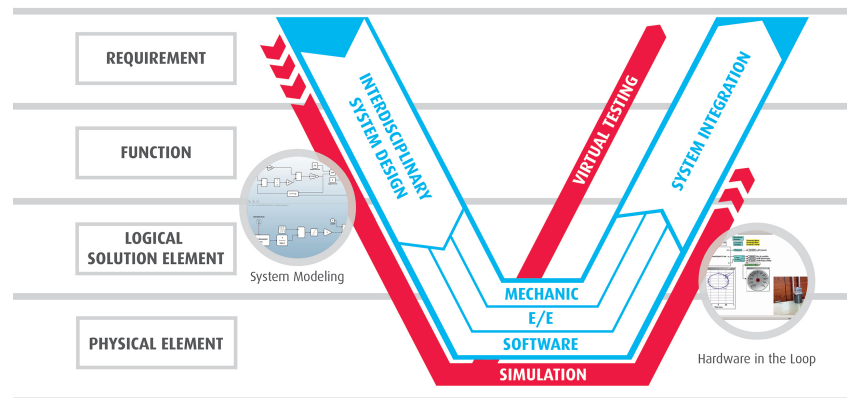


Figure 1 – The Systems Engineering “Vee” Diagram  
(Courtesy of Altair)

In the systems engineering view of product development, detailed component design is at the base of the “Vee,” properly being created well after a multitude of design decisions on product functionality, product architecture, and configurations have already been made. In concert with this thinking, companies are now attempting to drive simulation up front in the

development process, to the upper left side of the Vee. The big issue is that the product is less well defined, but complex and critical multi-domain decisions still need to be made early on. For example, the wheelbase of an automobile is not a dimension of any component in the CAD system. However, it is specified early in the development process and is a key parameter for many aspects of vehicle performance, for example, crash safety, ride and handling, occupant packaging, and even aesthetic design. This is a systems engineering problem, involving complex tradeoffs among conflicting or competing engineering requirements.

Many experts advocate a systems engineering approach to this problem, particularly embracing concepts from Model-Based Systems Engineering (MBSE). This has two key aspects:

- A view of the product as a system, comprising hardware, software/controls, and electronics subsystems and components, with functional, logical, and physical behavior aspects as specified in MBSE, and
- Digital models of the components, subsystems, and system that can be executed to understand their performance and behaviors vs. requirements. These models will have varying levels of complexity and fidelity over time, becoming much more detailed as the design evolves.

In the lexicon of model-based systems engineering, a “model” is a digital description and representation of multiple aspects of a product, including performance requirements. Physics-based simulations are used to evaluate adherence to those requirements. Altair has recently brought to market software combining several years of internal development along with recent acquisitions, in a trio of products now called solidThinking Compose, Activate, and Embed. These new tools address mathematical expressions in applications, state-based signal flows, and model-based development of embedded systems. By offering functionality traditionally provided in tools such as Matlab and Simulink, and in fact allowing legacy models to be used from those tools, Altair’s users can now access a full range of multidisciplinary system-level design software from within the HyperWorks ecosystem and combine them with traditional 3D CAE models. It is important to note that this MBSE approach enables collaboration across the domains of mechanical, electrical, controls, and software. Models describing the behavior of mechanical components can also be used for electrical system development, and vice-versa.

According to Dr. Hoffmann, “Altair is focused on performance and functional requirements. Product development should start with simulation a lot earlier, before the first CAD feature is created. Use optimization and conceptual tools to first define the function and worry about the geometry later. In addition, Altair’s flexible licensing model allows users to easily move from concept-level through detailed designs, both at a system level and with deep physics exploration.”

Altair’s innovative and patented on-demand software licensing system provides both value and flexibility, in that multiple users can access their software at any time, from anywhere. This includes access to complementary (and even competing) software applications from leading providers who have teamed with Altair through APA, the Altair Partner Alliance. For example, users can run partner applications like MapleSim Modelica and solidThinking Activate (for general system simulation) or DSH Plus (for hydraulic system simulation) using their pool of Altair Hyperworks license tokens.

Altair is also working aggressively to democratize access to design simulation technologies via the Cloud and other innovative SaaS software and hardware licensing models as well as addressing ease of use via their solidThinking portfolio, which includes the creation of industry specific vertical applications such as “Click2Cast” for casting solidification. Customers can also expect significant user interface enhancements this year to the traditional Hypermesh modeling environment for dedicated engineering analyst users.

CIMdata is impressed with Altair's product strategy for enabling systems simulation up front in the product development process to drive innovative product design concepts and by Altair's execution in developing a comprehensive portfolio of multi-physics solvers integrated with Altair's world-class optimization capabilities. The bottom line is that Altair has grown into a multi-physics systems modeling and simulation platform provider that can compete toe-to-toe with the major PLM market leaders and has the potential to be a disruptive force in their targeted industry segments.

CIMdata looks forward to tracking and reporting on Altair's progress over the coming years.

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