Bridging the Gap between EDA and MCAD

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Significant trends in new product development evident across all industry verticals continue pointing to increased content of electronic components and to further growth in global outsourcing of both engineering design and manufacturing. Driven by the demand for more sophisticated and customizable products, together with competitive pressures to reduce cost, these trends are expected to show continued strength over the next decade. In response, Cimmetry Systems, Inc. has introduced major new electronic design automation (EDA) capabilities in the AutoVue family of visualization and collaboration products that help to streamline the difficult task of integrating EDA and MCAD design elements.[i]

The growth of electronic components in new product design is evident in products ranging from high-end automotive with advanced GPS tracking systems and electronic engine controls, to the new breed of "smart" home appliances reaching the consumer market. Product development companies reacting to these demands, however, have experienced a negative impact in increased cycle time during design iterations as they try to assimilate data authored in very different applications. Cimmetry's AutoVue visualization and collaboration environment facilitates product design review and validation, product manufacturing, and all supply chain activities with support for the integration of disparate CAD databases into a final digital product assembly. AutoVue's extensive support for all popular 3D mechanical CAD formats, including CATIA, Unigraphics (NX), Pro/ENGINEER, SolidWorks, Solid Edge, I-deas, and Autodesk Inventor, together with EDA support for Cadence, Mentor, Zuken, and others, dramatically improve the flexibility of engineering teams to reliably merge in-process design data.

Pressure to deal with disparate design data from both MCAD and EDA authoring products has been building steadily as OEMs increasingly outsource product subsystem design and manufacturing responsibilities to supply chain partners. This is necessitated by the global shifts in the economy that have precipitated dispersal of product development into Asia for reduced cost, and regionally across all world markets to allow for targeted customization. AutoVue's visualization and collaboration role supporting both asynchronous and real-time interaction speeds the downstream effort in such areas as new product introduction (NPI) programs, product manufacturing, product marketing, and sales, as dispersed engineering, manufacturing, and field support sites finalize product design and production details. A wide range of authors and consumers of product data, including non-engineering workgroups, can access current designs, probe, validate, and communicate their approval or concerns within a unified environment.

Collaborative Product Development Associates (CPDA) sees the advances in AutoVue functional capabilities delivered in Version 18 for combined EDA and MCAD digital mockup as a strong drive forward for Cimmetry Systems that will help product developers bridge the gap between EDA, 3D mechanical design, and manufacturing.

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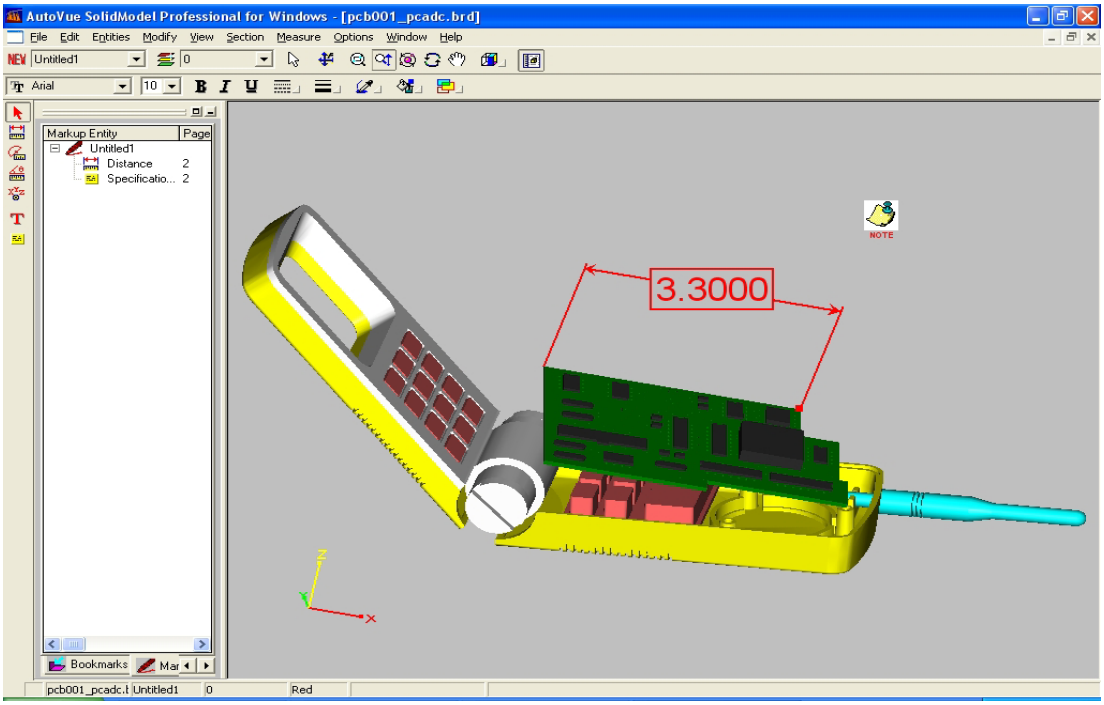
AutoVue Digital Mockup (DMU)

Manufactured goods are rarely composed of a single design object; the vast majority of products are made of multiple model components, both mechanical and electronic, that must be assembled into a working system. At numerous points during the product development process, the generation of a digital mockup of the intended product involves the virtual construction and assembly of all constituent objects. The digital mockup is used to check for errors in the product design and construction throughout the entire product development process. These analyses can involve the correct placement of disparate MCAD models, checking for collisions, certifying tolerances, electronic design rule checking, and production tooling.

With AutoVue 18, Cimmetry introduces a unique implementation that marries the two disparate technologies, EDA and MCAD, while retaining intelligence typically found only in authoring tools. Within AutoVue's visualization and collaboration environment, inter-object references are maintained between electronics schematics, PCB layouts, and their 3D realization within the 3D product assembly. In the 3D digital mockup, users work with the 3D PCB objects and MCAD mechanical components in a unified environment, manipulating components, measuring, performing interference checks, and adding markups. From this integrated setting probes can be launched to perform rules checking and investigate relationships between 3D PCB components and their 2D layouts and schematics. Electronics designers and mechanical designers all work in the same command realm.

Figure 1: View and Measurement within a Heterogeneous Electronics and Mechanical Assembly Mockup

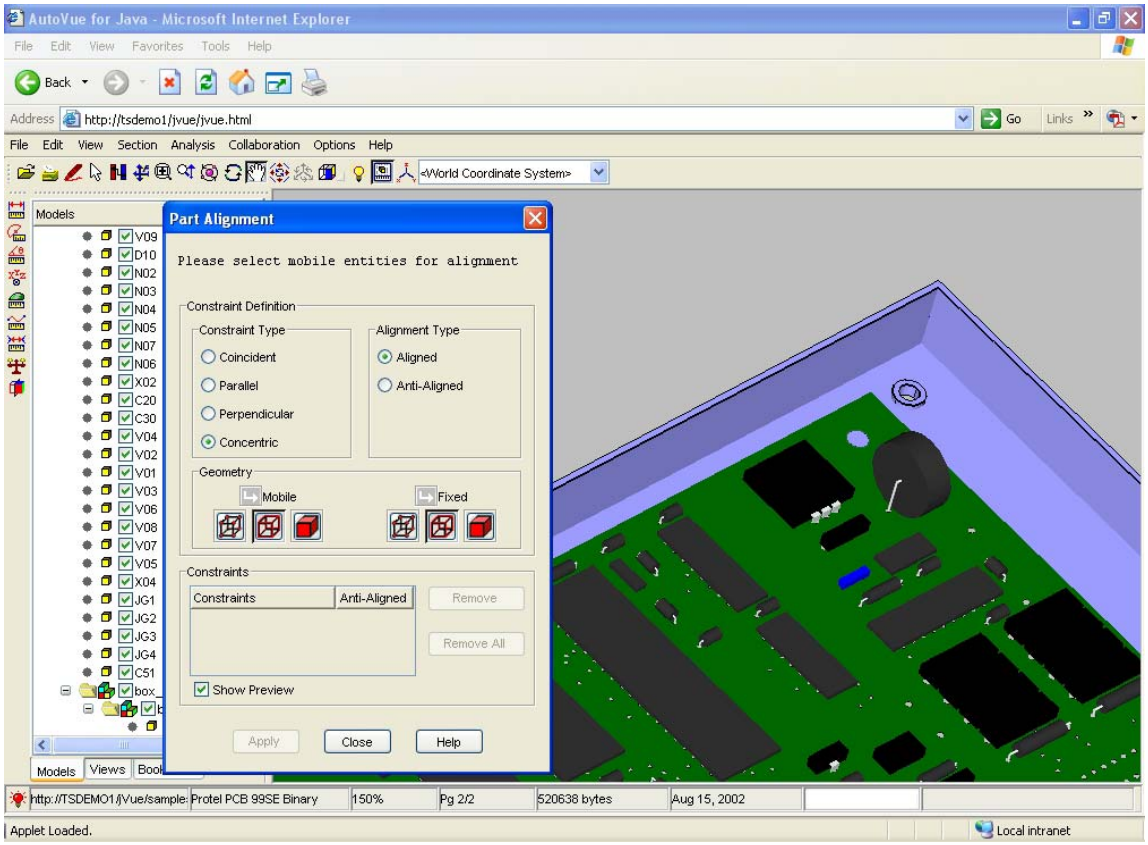


Part Alignment

In AutoVue 18, Cimmetry adds constraint controls to assist the user in positioning component models within an assembly. As users identify and place a new component part within an assembly, they may select one of four user interface options to align the part relative to existing assembly geometry. The inserted part may be placed coincident, parallel, perpendicular, or concentric to selected geometry. Although the constraint options are not persistent, the absolute placement of components within the assembly is remembered.

In AutoVue, users place and constrain a part model by first flagging the appropriate alignment type they wish to impose. Once the alignment condition is specified, the user interface (shown in Figure 2) requests that the user identify a "mobile" point, edge, or face on the part model being placed relative to a "fixed" point, edge, or face in the existing assembly. The component part is then automatically transformed (rotated and translated) correctly based on the nature of the specified constraint.

Figure 2: AutoVue User Interface for Part Alignment



The new Part Alignment tool extends the ease of use in part placement well beyond the general-purpose part transformation capabilities (translate, rotate, and mirror) found in the product. While the general purpose tools are necessary for a robust implementation, users can relate best to relative placement and thus avoid what at times could involve time-consuming calculation of the proper rotation angle or translation vector needed to position a part correctly.

Assembly structures created in AutoVue, including any user-imposed alignment of component models, can then be saved between sessions and shared with collaborating partners.

Cross-Probe Capabilities

AutoVue 18 retains the cross-reference intelligence found in EDA authoring products. Designers proceed from the creation of a logical schematic of their design to its realization as a printed circuit board (PCB) layout. AutoVue records and maintains the inter-relationships between the two in the AutoVue visualization environment. Users can select a net, component, or other construct within the schematic, and AutoVue highlights its physical realization in the PCB layout. AutoVue can also generate a 3D view of a PCB layout with the information contained in the EDA file. In addition, users can cross-probe between the 3D view of the PCB within an assembly and the 2D views of the PCB layout and schematic.

Consider a design scenario of a 3D interference between a PCB electronic component placed within a mechanical housing, similar to the product view depicted in Figure 1. During design verification in AutoVue, the user can identify the area of interference on the 3D view of the PCB, and then cross-probe across the PCB design layout and schematic, to offer a possible revised physical component placement on the PCB that avoids the spatial overlap. Of note, Cimmetry's AutoVue is first to market with this unique capability.

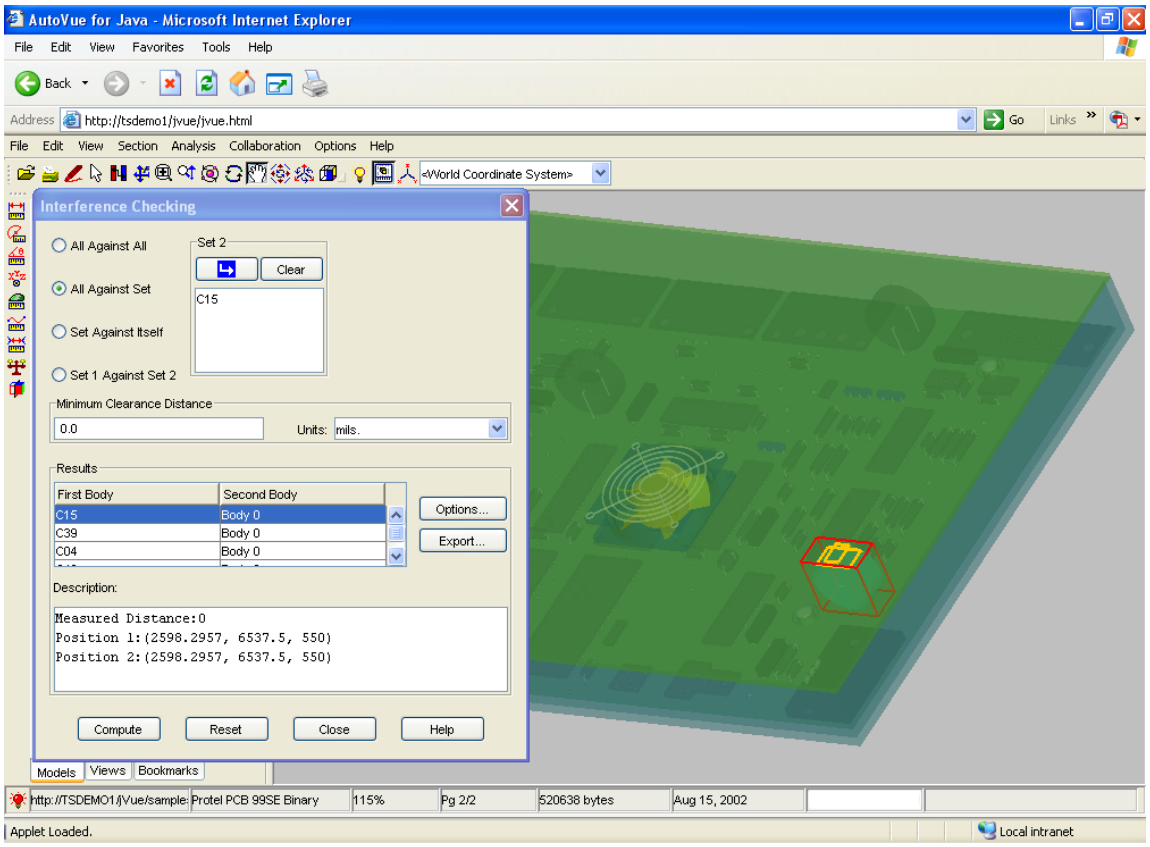
AutoVue also provides users a range of visibility controls to aid in their inspection of electronic schematics, their realized PCBs, and their interdependencies. Each layer can be assigned an independent color and rapidly toggled on and off to assist the user in narrowing their viewing attention.

3D Interference Checking

Designers expect a robust list of options for 3D interference checking, and AutoVue delivers. Whether the need is for a full, final validation of an assembly design (checking for an interference between any of the component models in the entire assembly) or a more focused examination between specific components (or sets of components), the AutoVue user interface provides an appropriate option that allows the user to articulate their request (see Figure 3).

Project leaders will find the full interference option exceptionally useful as a final check on a completed design to assure that all possible interferences have been resolved, and should be a standard practice followed by all design teams prior to release of a product design to manufacturing. The more restricted options comparing a user-selected set of component models (one part or a list of parts) against all components in the assembly prove valuable in situations where a supplier is providing the design of a product subassembly that must be validated against the full assembly.

Figure 3: AutoVue User Interface for Interference Checking



As would be expected in any such implementation, the broader the scope of the interference check, the more extensive the computations required. AutoVue interference checking provides an advanced capability to perform all clash-detection calculations within a “minimum clearance distance” between models. That is, the user can specify a small tolerance envelope distance around the models, and the software will validate whether or not that margin of error is violated.

While other products perform 3D interference checking, the AutoVue implementation stands out in its attention to detail in both its calculation and when dealing with the results of the calculation. The Results window of the user interface lists all interfering pairs of component models, any of which can be user selected to display a zoomed-up view of the particular interference. In addition, recognizing that such interferences will not be resolved immediately in any real-word product development process, Cimmetry allows the results to be exported and saved for the later attention of individual designers.

Product groups can fully integrate the AutoVue visualization and collaboration environment with their PLM (Product Lifecycle Management) implementation. Cimmetry Systems provides a full set of APIs (Application Programming Interfaces) that can be used to populate fields with most commercial PLM products capable of accepting input for changes in component placement and alignment within an assembly, together with collision detection parameters computed within an AutoVue session. These combined capabilities offer users a streamlined development setting that minimizes risk of human error in capturing change.

The Collaborative Environment

Over the past few years, CPDA has observed a major shift within most product development companies toward a heightened attention to project or program management as opposed to functional organization control. The project or program delivers the product; the product delivers revenue and profit to the company. Team effort of all project participants moving in step with the project goals, timetable, and budget is critical for success. The need for timely, reliable communication is an essential ingredient of that team effort, which now likely spans engineering and manufacturing workgroups distributed across the enterprise and supply chain worldwide.

Collaboration tools such as Cimmetry's AutoVue enable active participation in product design and production, not just from engineering, but also across internal and external developers, suppliers, manufacturers, field service, and throughout the entire supply chain. Participation translates into taking a proactive role in visualizing the full product digital assembly, probing its various designs and interdependencies, verifying the correctness of the design, and commenting on needed corrections or improvements at each stage of product development.

AutoVue provides a wealth of flexible tools to enable that communication. Product assembly mockups supporting both EDA and mechanical components can be shared asynchronously or in real time as best suits the immediate need. AutoVue functions such as co-viewing, co-markup (co-redlining) of the designs, chat, and recorded audit trails to track which product changes were made, why they were made, and who made them, ensure project reliability and accountability.

Summary and Conclusion

Cimmetry Systems' AutoVue 18 zeros in on meeting the needs of product developers in today's competitive market. The AutoVue visualization environment facilitates product design review and validation with integration of disparate EDA and MCAD databases into a final digital product assembly. Cimmetry's digital mockup has taken an industry-leading position in bridging the gap between intelligent EDA and MCAD for product visualization and validation tools. Strong capabilities in interference checking, electronics design rule checking, and innovative cross-probe functionality make it a leading solution for product manufacturing companies struggling to manage their new product introductions through widely distributed partners and the supply chain. CPDA recommends all product developers investigate Cimmetry Systems' AutoVue 18 as their visualization and collaboration product of choice.

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[i] For more information on Cimmetry Systems, Inc. and their AutoVue product line, see http://www.cimmetry.com.