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Manage all design and manufacturing processes

Alex Chernyak describes System CAD (SCAD) as a new method of managing all activities during system design and manufacturing processes of electro-mechanical equipment.

Note: Readers of the Editor's free email newsletter will have read this news the week it was announced. Send us a blank email now to join the circulation. It's free!

Design of modern electro-mechanical equipment has become a complex task where competitive pressures demand rapid introduction of innovative products. To be a market leader a company has to operate quickly and efficiently reducing costs and streamlining the take to market process. A primary business driver today is progressing product complexity and customisation.

Products increasingly include intricate mechanics, electronics, and software.

The most effective way to improve the product design process is to account for all component attributes and design constraints at the concept stage.

That is why in attempt to achieve dramatic productivity increases, companies are increasingly turning to CAD tools and PLM systems.

However, the existing tools only improve specific portions of what is still considered to be a manual and highly error-prone design process - and are not designed to automate the process at a systems level.

Additionally, more than two-thirds of the typical engineering process involves routine, time-intensive tasks.

The challenges are therefore to improve the speed and effectiveness of the product development process, radically reduce the time taken to create new innovative designs, and provide significant savings across every part of the design to manufacturing cycle.

With these challenges in mind, TurboTools is the first company in the industry that offering the next generation engineering automation solution that goes beyond the capabilities of traditional EDA applications.

Bridging the gap between MCAD and ECAD tools, TurboTools solutions define the new market segment for EDA tools called System CAD or SCAD.

TurboTools views SCAD as an entirely new level of managing all design and manufacturing activities during the system integration.

SCAD functionality will go not only bridging the gap between mechanics and electronics, but also will manage both disciplines under one umbrella.

SCAD tools, when mature enough, should take leading role for entire design process for electro-mechanical equipment.

TurboTools' flagship product, CablEquity is the first product in the SystemEquity family that will revolutionise the Hardware Electrical Systems design process.

The solution is based on TurboTools' patented methodology that represents the entire Hardware Electrical Systems (HES) design, manufacturing and validation as an enlarged SoC.

CablEquity is an out-of-the-box interactive end-to-end design environment for cable and harness assemblies.

CablEquity combines the management of electrical and mechanical requirements to fully automate the product design including: * Import/Export to and from CAD systems.

* Components search and selection.

* Design rules check and product validation.

* Product Lifecycle Management.

* Automatic output of all required engineering drawings and documentation.

The idea behind CablEquity was inspired by discussions with industry leading electro-mechanical equipment manufacturers deeply involved into design of Hardware Electrical Systems.

Typically, electrical harnesses are designed and released to manufacturing without optimisation of components, and frequently with design faults.

These design faults may need to be fixed or patched as a costly, secondary manufacturing process.

Also, because functional specifications of complex electro-mechanical systems are changed constantly, harness design has to be constantly updated to fix the problems of the previous release and to incorporate the modifications for the latest system features.

In addition, Hardware Electrical Systems must integrate a large number of components and account for the multitude of requirements such as heat, interference, resistance, and so on.

Typically the design of electrical systems is started late in the process, and can take months to complete.

The resulting design is rarely optimum.

Analysis of the electrical design process in number of companies form different industries reveals a common list of problems that include: * Poorly defined development process.

* Absence of tools or procedures for applying hierarchical design methodologies.

* Poor integration between design teams involved in design.

* Poor integration between MCAD and ECAD tools.

* Absence of a formal process for capturing previous knowledge.

* Lack of procedures and processes to enforce design consistency.

* Prevalence of manual, tedious, and time-consuming steps.

Although it may appear that the electrical design process has been significantly enhanced through the use of CAD tools, in reality these tools have been developed to automate design tasks without reference to the actual design requirements.

At no stage, however, has the process been improved to more closely match the way that designers think about the design requirements.

There are opportunities for incredible savings through usage of improved design tools and processes.

Deployment of an automated design tool, which can reliably apply best practice design procedures, offers the possibility of significant reductions in the design cycle time as well as an improved electrical system performance.

CablEquity interactive design environment, re-engineers the electrical design process so that a higher quality of design can be achieved in a much shorter period of time.

CablEquity allows engineers to capture, represent, and verify the entire electrical system working through a series of steps that capture and enforce design requirements.

The definition of a Hardware Electrical System requires the integration of a number of different viewpoints of the product.

For instance, the system can be seen as an assembly of a large number of simple electrical circuits, or it can be seen as a challenge to mechanical engineers as they seek to find the optimum routing of the cables in order to minimise the weight and simplify installation of the cables; or, it can be seen as an assembly of components whose cost can be optimized by proper selection of component specifications.

This is where the power of CablEquitys pays off allowing engineers to address the full spectrum of design challenges.

First and foremost, the interactive design environment offers the ultimate flexibility for engineers allowing them to design electrical systems using either top-down or 'bottom-up' approach.

Secondly, the reach database with parametric cross-reference search engine speeds up component selection while enforcing design rules.

And finally, the whole system can be validated at the design stage.

* Changing specifications - one of the largest limitations of the established design processes is the resistance to changing design specifications.

Growing complexity and the interconnected nature of the modern systems forces engineers to start cables and harnesses design when the specification and layout of the entire system is more or less complete.

If the designers attempt to begin the electrical design task earlier, when specifications are still changing, then they find that much of their previous work is rendered obsolete each time something changes.

For example, moving the location of the SCSI controller by some distance may appear a simple modification.

After all, the connectivity of the SCSI cables will remain the same although their individual lengths will, of course, change but here is the problem.

Changing the lengths of the SCSI cables affects the resistance of the cables and specifications for the SCSI bus.

Changing the resistance of the cables changes the voltages within the attached circuits.

Each of these circuits will have specific requirements for power and voltage at key components.

Changing the location of the SCSI controller has therefore impacted on no working condition of entire SCSI bus.

Changing the location of one component can require the redesign of interconnects or even attached circuits.

The problem is amplified because a large proportion of the cables within a complex system service more than one circuit.

Sometimes the process is so complex that in most instances the designer is unable to define directly the component and cable parameters to meet the circuit requirement.

Instead, designers have to wait for a live prototype to discover whether the resulting performance meets the requirements.

The designer then begins to tune the individual component and cable parameters until the analysis tools show that the required performance has been achieved.

The process of creating the electrical system is therefore, not surprisingly, measured in months or sometimes even in years.

Traditional software tools have provided support to individual parts of the design process but have offered little in the way of true integration.

Indeed, the task of integration has been left to the designer, who must ensure that when a change is made, each of the individual software tools used in the process is properly updated.

These traditional tools are characterised by a requirement for a large amount of time-consuming human interaction before they can complete their task.

The requirement for the designer to maintain consistency between each of the software tools provides a further opportunity for errors to be introduced.

With CablEquity, any change request can be processed and validated in a matter of minutes.

Extensive versioning and project management capabilities of the system eliminate the internal resistance to change and results in better designs.

CablEquity eliminates design errors by ensuring design correctness and completeness at each step of the design workflow.

It allows the user to work with an entire design process in terms of engineering design rules and to integrate any number of design methodologies into a single product.

To end users this means that they can move effortlessly from electrical specification to engineering drawing and documentation within a single unified experience.

The design rules, which are embedded within CablEquity's business logic and the Parametric Search Engine, allow complete automation of all routine design activities.

The design engineer only sets the requirements, and the system automatically generates all required documentation, which meets the design goals.

The automated process is fast, error-free, and uses a series of design optimisation strategies, which would be too time-consuming for traditional design methods to use.

A process, which has traditionally taken days or weeks, can now be completed in minutes.

Using CablEquity, companies can begin electrical system design early.

Even though accurate components requirements are not available in the early stages of design, the user can specify expected parameters and then refine the component values as more accurate information becomes available.

This iterative process is made possible by the next generation speed in design completion.

Product definition is not limited to engineering design.

It also includes information about iterative changes that are made during the product's lifecycle.

This information must be maintained throughout product lifecycles and leveraged in future products.

That is why CablEquity includes powerful Product Lifecycle Management capabilities for product-centric configuration management, document management, and rapid change management.

Changes, which are made to any design, will automatically generate a new version of documentation.

This allows designers to leverage previous versions at a later time, allowing preferred design methodologies to be encapsulated and applied to future designs.

To optimise operational efficiency and minimize development costs, electronics and technology companies need to automate key business processes associated with their product lifecycle.

An integrated design environment, or SCAD, is guaranteed to accelerate product introduction, improve product margins, or integrate a complex supply chain.

* About the author - Alex H Chernyak is the President and CEO at TurboTools Corporation (San Francisco, California, USA).

TurboTools provides an EDA/PLM enterprise solution called CablEquity for hardware electrical systems.