Product Configurators: The Big Picture

by Ulf Strom and Alan Axworthy

The need for manufacturers to respond to customer demands in Internet time is placing new demands on information systems. One response to these demands is the rapid evolution of product configurator applications, from the role of standalone tools to richly featured components of an integrated system for design collaboration. Product configuration software packages available today range from simple graphical and menu-driven tools that support generation of accurate sales quotes to highly integrated systems that act as a bridge from sales to engineering and production. Many manufacturing organizations look to their ERP vendors for this functionality, and many of these vendors have responded by either developing their own systems or by partnering with configurator providers. Consequently, capabilities vary, from simple selection among a pre-defined set of options to highly intelligent engineer-to-order (ETO) systems that can generate unique solutions to specific requirements.

Types of configurators

Choosing the best configurator for any particular application depends largely on the complexity of the product being built, how extensively it must be tailored or customized and the enterprise applications with which it will be integrated. Product complexity and customization requirements serve as a good point of comparison between three major classes of configurator products.

Assemble to order (ATO). Available from many product data management (PDM) and sales automation tool suppliers, the basic ATO configurator is designed to produce a bill of materials (BOM) from a fixed set of standard parts, pre-defined combinations and a limited number of substitutions or exceptions. Personal computer configuration tools are one example of this category. As product ordering has moved online, this type of configurator has proven capable of supporting direct access by purchasers, and has given individuals who have no particular design or configuration expertise the ability to choose a limited set of features and specified extras. The BOM output from a basic configurator can be used to drive creation of a pick-and-pack or pick-and-assemble punch sheet, while insuring accurate and timely invoicing.

Build to order (BTO). A BTO configurator supports greater levels of complexity by applying simple engineering rules to the pick-and-assemble process. The components used in the

product are still principally drawn from a database of available items, and rules define assembly layout and other specifics for each product built. The software generates custom assembly instructions and, if needed, drawings. Large-scale electrical switch boxes are a typical product well-suited for BTO configuration. Each electrical switch contains a standard circuit breaker, meter and cabinet components. But the arrangement, and hence quantity, of the copper bus bars connecting breakers is a variable, affected by the location of the components within a cabinet. Different component arrangements will generate different busing schemes, which in turn can substantially affect manufacturability and cost.

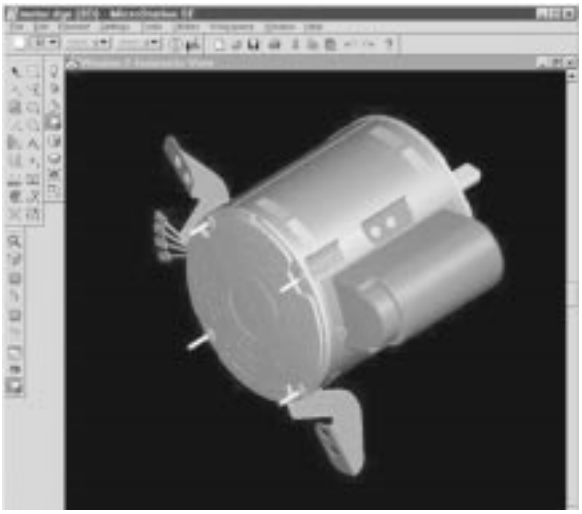

Figure 1. A leading producer of electric motors for appliances uses a configurator to customize its products for OEM customers.

Engineer to order (ETO). To create products that are engineered for a specific customer requirement using both standard components and customized parts, a much more intelligent configurator is necessary. Driven by knowledge-based software, this type of configurator can produce unique and complex systems using engineering rules defined by experts in a given field. The output from these ETO configurators includes assembly drawings, assembly details, part specifications and even numerical control code to drive fabrication equipment for the customized parts.

Specialized electric motors are one type of product that benefits from an ETO product configurator. While many of a motor's components might be selected from a catalog, some elements, such as the shaft, must be engineered for the specific requirements of the motor application. The use of predefined shafts is impractical due to the many combinations of alternatives. But shoehorning each individual one-off part into a PDM part-numbering scheme is an inefficient and unnecessary effort. An ETO configurator can replace part number proliferation with a flexible system that applies engineering rules to define and then produce the custom part.

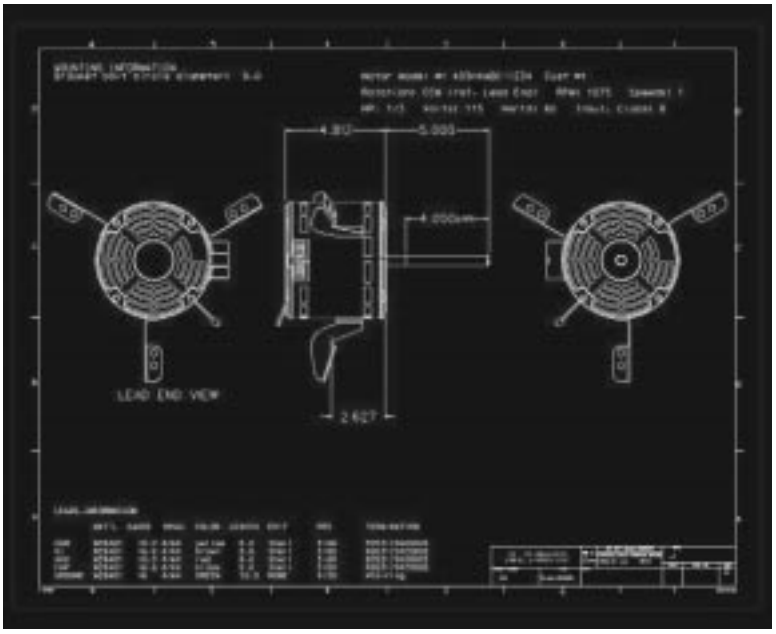

Figure 2. The motor design shown in figure 1 can also be viewed as a fully annotated dimensional drawing for design review.

ETO configurators at work

One of the world's leading producers of electric motors for household appliances uses just this type of automated ETO configuration system to design specialized motors for its OEM customers. The system accepts the mechanical and electrical specifications required for the motor, which are developed in discussions with customers. Applying rules that have been captured in the configurator's knowledge base, the software automatically produces a detailed, fully-engineered motor design. This design can be viewed as a 3-D image (figure 1) or in fully annotated and dimensioned drawings produced by the system (figure 2). This enables immediate review of the design, before a prototype motor is manufactured for testing. Changes for form, fit and function can be implemented, and these changes are reflected in all drawings and any required technical documentation.

Another excellent example of a knowledge-based ETO configuration system at work is the system developed by Robertson Ceco Corporation (RCC), a leading supplier of custom metal buildings. To automate the design of 6,000 new structures annually and feed data to a manufacturing system that produces all of the custom structural and finished parts for delivery to the job site, RCC has deployed this system across more than 100 seats. The complex building designs, sometimes configured with more than 100,000 parts into a single product, need to be reviewed early and frequently throughout the design process. The ETO configuration system lets designers and customers review three-dimensional models of the custom buildings earlier than ever in the design process, and instantly implement any desired changes.

The system accepts design inputs, such as the building envelope and openings, local building code information and desired finished appearance. The system determines what components are needed (configuration), engi-

neers each component using standard stock, and places the components in space to form a fully detailed 3D model of the building (figure 3). It then creates a complete set of manufacturing and erection drawings, outputs NC code for the fabrication equipment, and generates parts lists for RCC's ERP system. With a seven-fold reduction in quality expenses and a 20 percent overall productivity increase during a time of severe shortage of technical designers, the ETO configuration system has provided significant competitive advantages to Robertson Ceco.

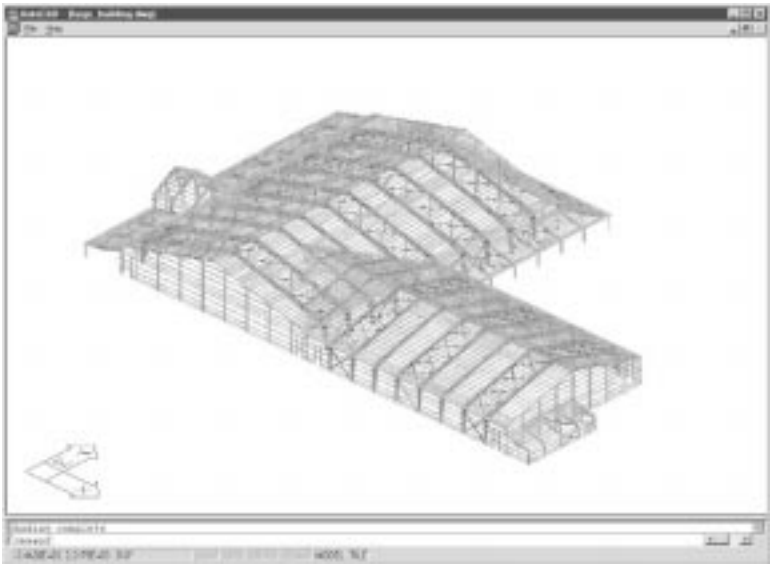

Figure 3. Robertson Ceco Corp. uses a knowledge-based ETO configuration system to create custom building designs.

Key ETO capabilities

To help manufacturing managers evaluate configurator systems, it is useful to summarize the key capabilities of advanced configurators.

Visualization. Seeing truly is believing. While many simple products don't require ready access to visualization, more complex designs benefit tremendously from this type of review capability. The benefits of seeing a building design are self-evident. But the ability to visualize a small motor design, and potentially transport this visualization to its place in a larger assembly, may highlight interferences or installation issues not easy to spot in a two-dimensional drawing.

Degree of customization. We've seen how selections driven by predefined part and component options limit the scope of simple configurators. It is often necessary to engineer parts to suit specific product functions, not merely choose the closest standard part or select an option on a standard part. A configurator can act in a parametric manner on materials and generate control instructions for machine tools to provide significant added value.

Knowledge capture methodology. Engineers must be able to describe their product knowledge in a way that is natural for them, but can also be programmed quickly into the configuration system. Managers should ask very specific questions about the methodology used to capture knowledge, the length of the application development cycle and how responsibilities are defined for this critical task.

Integration. As noted in the RCC example, the ETO configurator is closely linked to other systems, at both the NC-code generation level and to the in-place ERP system of the manufacturer. The requirement for integration with databases, CAD systems and legacy engineering analysis applications should be well-defined at the outset of system evaluation.

When linked to ERP, PDM and even manufacturing execution systems, configurators play a key role in automating design and engineering of the types of complex products common in the business-to-business environment.

Scalability. The nested assembly nature of many products (layered subassemblies, each with a great deal of complexity) can strain the ability of a many ETO configurators. As with any complex software system, it is important to consider both the current application and potential upgrades of a successful deployment, and select applications that scale in an appropriate way.

Today's need to improve customer responsiveness and deliver products, my way, right away is driving significant changes in manufacturers' use of information systems. When properly planned and implemented, the return on investment for integrating product configurators into the family of enterprise IT solutions drives a number of benefits on the front end, such as more accurate costing and better communication with suppliers and customers. It also insures consistently optimized design and faster time to market. When linked to ERP, PDM and even manufacturing execution systems, configurators play a key role in automating design and engineering of the types of complex products common in the business-to-business environment. As a result, competitive pressures will speed the arrival of ETO configurators as a standard application in the portfolio of manufacturers in the B2B marketplace. ◆

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