Variant Design and Generation

Customers want – indeed, expect – “personalized” products today, and they’ll give their loyalty to those manufacturers who provide the widest variety of products and the fastest response. Moreover, business and market conditions now demand that companies deploy methodologies that deliver the lowest cost and shortest development and sales cycle. An effective variant design and generation process is necessary to respond to these challenges.

Definition of Variant Design and Generation

Variant design and generation is concerned with defining configurable product platforms via a modular approach to product definition and frequent reuse of existing designs. From these definitions, new product variations can be derived in response to specific customer proposals, and entirely new products can be developed for particular markets.

Define and manage multiple design configurations to accommodate design alternatives and improvements

Source: PTC Industry Marketing identified trends
Understand the Need for Variant Design and Generation Process

Successfully utilizing flexible platform designs and managing the complexity of multiple configurations is key to competitive differentiation. Without a trusted variant design and generation process in place, it is almost impossible to accurately price proposals to ensure profitability. Lack of early insight into cost characteristics of the new product variant often results in high built-in price-safety margins, which drive the win rate down. Delivering the new product variant in time or ahead of the competitors becomes unachievable.

Cost of product development is a key factor in staying competitive. Without effective variant design, the engineering cost of a new product becomes too high. Companies are constantly attempting to streamline repetitive product development process steps, increase ease of reuse of existing parts, and lower the cost of managing multiple product versions for each market opportunity or channel.

Inadequate coordination between engineering domains and across product families leads to quality issues. Design proposal reviews with customers are ineffective and tracing change impacts across a product family problematic. And once a product is released to production, the continual need to synchronize product options with sales configuration and ERP systems takes on particular importance to the maintenance of product quality.

Benefits of an Optimized Process for Variant Design and Generation

By adopting an effective variant design approach, companies can deliver improved customer service, greater product choice, and higher quality product configurations. This leads to faster customer responses and more accurate customer proposals. Moreover, associated product costs are lowered since the indirect expense (engineering, development, manufacturing, operations) of a single underlying product platform is spread across many product variants.

Increased Design Reuse
- Increased number of new products that are modifications of existing products
- Higher number of design-to-order product configurations that are driven from existing configurations
- Higher average percentage of BOMs using standard parts
- Increased revenue based on standard platforms

Reduced Engineering Costs and Improved Predictability for Variant Creation
- Smaller number of projects exceeding the proposed cost/budget
- Increased automation of detailed design via 3D CAD models
- Improved automatic creation of engineering, assembly, and manufacturing process drawings
- Improved team efficiency to maintain and expand product line

Improved Product (Variant) Quality and Reduced Time-to-Order for Variants
- Lower number of changes necessary to resolve product (variant) integration issues
- Faster product introductions with increased number of initially offered product configurations
- Shorter average time-to-customer for a design-to-order product

“BMW perceived a growing desire in society for greater individualism. People were beginning to make more individual choices—car buyers were becoming increasingly difficult to pigeonhole. They were making more discerning choices and car choices were no longer homogenous, based on your job and salary. This translated into the need to do more individualistic cars.”

Adrian van Hooydonk, BMW’s Chief Designer, BusinessWeek, October 2006
The Solution – PTC’s Product Development System

The typical variant design and generation process has two major phases: generic platform design, and specific variant generation.

Four steps are typically executed during the generic platform design:

1. **Analyze platform optionality needs.** The first step during the generic platform design is to analyse and fully understand requirements of the new product and to plan different options to satisfy the same.

2. **Assess Current Products for Reuse.** Depending which specific variant design methodology is needed (Assemble-To-Order, Configure-To-Order, Engineer-To-Order), different existing variant designs are investigated for reuse in order to shorten development time and effort.

3. **Create Generic Product Definition.** During this step, the product design is structured in such a way to support product optionality. Existing data, parts, and components are reused, or new ones are developed. The rules and logic needed to select the product options are defined. Rules and structure are evaluated and iterated, as necessary.

4. **Release and Maintain Platform.** Upon successful design and validation of the generic platform, it is released to manufacturing. Any changes to the platform are managed and the platform is modified as needed.

Four steps are typically executed during the specific variant generation phase:

1. **Analyze Specific Variant Needs.** Depending on the situation, market-specific or customer-specific needs are analysed.

2. **Assess Current Platform for Reuse.** The existing generic platforms are evaluated in order to select the one best suited for variant generation.

3. **Create Variant Definition.** The variant options are specified and used to generate initial deliverables, including 3D CAD models, drawings, and other documentation. The specific variant design is edited and modified, as necessary.

4. **Release and Maintain Variant.** Once the specific variant is generated, it is released to manufacturing. The variant definition is maintained and modified, as needed.

The new 500 is a 3-door model with very compact measurements: 355cm long, 165cm wide, 149cm tall and a wheelbase of 230cm.) Produced with three engine options: a 75 bhp 1.3 16v MultiJet turbodiesel and two petrol engines, a 69 bhp 1.2 8v and a 100 bhp 1.4 16v, with five or six-speed manual gearboxes, the new Fiat 500 is designed to be notably entertaining to drive.

– BusinessWeek, March 2007
Critical Capabilities

PTC’s Product Development System provides the following capabilities needed for effective deployment and execution of the variant design and generation process:

- Single, Web-based, structured, cross-discipline solution for integral management of complete product and project data including electrical, mechanical, software, and documentation elements
- Top-down product design tools - flexible and reusable CAD platform creation
- Powerful logic definition creation with variant rules and constraints captured and managed at the BOM level
- Comprehensive product configuration and design automation tools - flexible and scalable user interaction
- Automatic component replace capabilities
- Automatic deliverable creation capabilities
- Integral part classification search and reuse
- Configurable technical publications

PTC – Uniquely Qualified

An automated and optimized variant design and generation process not only requires superior technology, it also requires companies to change the way they work on a day-to-day basis. Just as important, companies need to ensure everyone across the organization understands and adopts the new processes and technology.

After 20 years of deploying process and technology improvements across thousands of customer sites, PTC’s Global Services team understands what’s required for companies to be successful. We offer solutions that include the right blend of process consulting, system implementation, and education services, so customers realize the most value from their PDS investment. We implement industry best practices that fully leverage PTC technology, so companies can take advantage of the solution’s potential, while avoiding costly customizations. Plus, each of our solutions incorporates a unique training approach that accelerates the adoption of new technology and processes.

“...the customer doesn’t care that you can provide just about anything. They only care that you can provide what they want. In order to compete effectively, mass customization must come without additional cost and complexity for the customer”

Aberdeen Group - Mass Customization of Highly Configurable Products by Jim Brown, Tech-Clarity Associates