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Design Automation of Flange Coupling using NX 10.0

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Abstract - *The CAD/CAM software available in the market are general purpose software. These software are not developed for particular user or a particular task. The process of modelling of the software for particular application to suit the specific requirement of the customer is called as customization of software. Various industries use UG/NX to perform the task of solid modelling, assembly modelling and drafting of the various engineering products. Due to the wide variety of applications, couplings of various types are used frequently by many industries. The aim of this work is to customize UG/NX CAD/CAM software, to provide facilities that generate three dimensional part model of Flange's coupling, and its assembly model using knowledge fusion programming.*

Keyword - NX 10, CAD, Flange Coupling, Visual Studio

1. INTRODUCTION

The concept of mass customization has become increasingly popular since the 1990's (Pine, 1993). This is due to customization offerings a competitive advantage to companies with increased customer value. Furthermore, in keeping with the evolving paradigm of mass customization, Meyer and Utter back (1992) also introduced the concept of product family design, where standardized products can be replaced with specific features and functionality according to customers' specific needs and desires. One may conclude by these studies that by automating the design process to allow the customer more range of direct, interactive control with the design, companies could experience a significant reduction in operation costs. With today's emerging markets and product variety, it is very important for industrial companies to explore product customization to capture customer attention and deliver true customer value. The challenges are formidable, especially with today's customers who consistently demand "a product with the highest quality, fastest delivery, and highest level of product customization" (Kumar, 2008). Unfortunately, most of today's product customization falls under the category of customized standardization (Lampel & Mintzberg, 1996), where the customers are not involved in the design and manufacturing process, as depicted in Figure 1 below.

Computer-aided design (CAD) software available in market are tremendously improving the productivity of designer by facilitating various features that reduce the product development time. However, it is observed that most of the manufacturing industries frequently design and manufacture similar type of components only or the assembly often consist of use of standard parts. The designer has to model the similar products repeatedly in both cases. This is not only time consuming but also it creates fatigue in the designer's work. If designer is provided with custom programs for parts and assembly, he has to only input values for key parameters in the dialogue box and the part will automatically get generated.

1.1 Objective

- Consistent designs
- Ease of use, allowing low skilled manpower to handle design load
- Increases the productivity
- Minimize errors
- Link CAD to other applications, such as MS-Visual Studio using the latest technologies
- Faster designs
- Accurate designs sticking to standards
- Automation of CAD is done essentially to minimize the time consumption and maximize the productivity; this is done ARX, Lisp and VBA with enhancement in Auto CAD instruction and producing well-informed drawings.

1.2 Future Scope

- CAD Automation is mainly used for Facility management, Hotel Industries, Symbol or block management, File Data management and so on.
- Digitize design outputs in the form of 2d drawings, 3d models, prototypes
- Avoid repetitive tasks in design

1.3 Methodology

The purpose of this project was to create a tool to allow customers to be more involved in the design phase for product customization through the use of an interface that is seamlessly integrated with CAD's system API. Figure 4 displays the system architecture for this project.

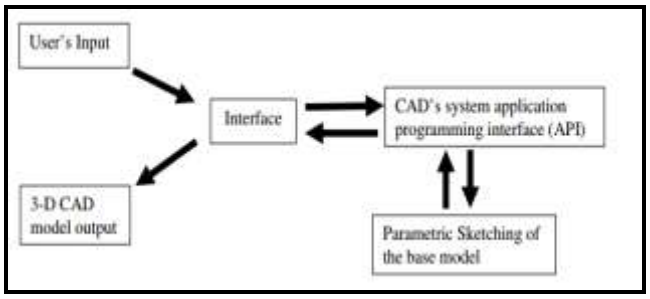

Fig.1.5 The system architecture

Basic activities and information flow of the system architecture are summarized by the following description:

- A user-interface form was developed for the customers using Visual Basic language.
- Customers input values for pre-identified feature dimensions for a product mode.
- A new product model will then be design according to the customer's parameter values via CAD's system application programming interface (API).

In short, this technique provides customers with the ability to make design changes to the product without the need to possess design skills in CAD software. In essence, this method attempted to close the gap of misinterpretation in product customization between the design engineers and the customers. Most importantly, this project educates the customer about what options are available for them.

2. CUSTOMIZATION LEVELS

The major CAD systems have a wide range of customization interfaces that go from as simple as assigning commands to function keys to complete development environments including high level programming languages and resource compilers. CAD systems usually offer the following choices:

• Function keys assignment: This is a fairly simple way to issue a written command. The keys, frequently named F1, F2, etc., are assigned a command that is "typed" whenever the corresponding key is pressed.
• Configurable menus: New items are added to the standard menu tree of the program. The new item, represented by a word or icon, is assigned a command to be executed when it is selected. Sometimes, creating menu items can be a fairly complex task.
• Scripts: These are simple sequences of instructions stored on disk files that are run through a specific command of the CAD system. By assigning scripts to function keys or menu items is possible to speed up many tasks.
• Symbols library: Different CAD systems call them blocks, parts or cells. A symbol is a small drawing of a frequently used part. Symbols are assigned names and are placed in the design with arbitrary rotations and/or scale factors.
• Interpreted programming languages: These are proprietary programming languages whose interpreter is built into the CAD program. AutoLisp (for AutoCAD), UCM (for Micro Station) and CADL (for CADKEY) are a few examples. Some of them, like AutoLisp, resemble high level programming languages.
• Compiled programming languages: Similar to interpreted languages but the source code needs to be compile before it can be used. Compiled customizations run faster and are better suited for large applications that can easily have many thousands of source code lines. ADS (for AutoCAD), MDL (for Micro Station) and DCAL (for Data CAD) are some examples.

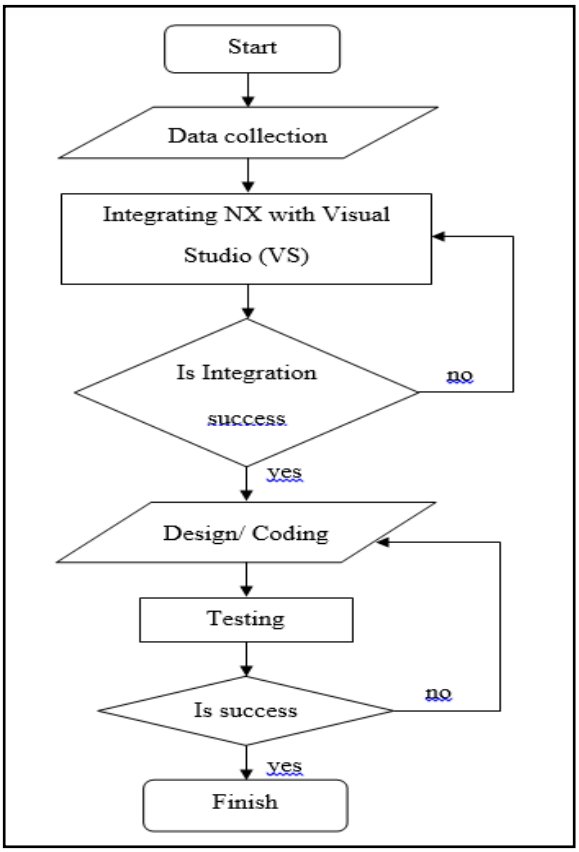

Chart -1: flow chart for project process plan

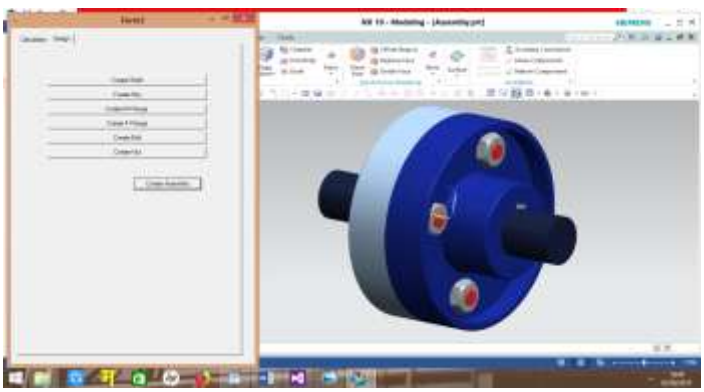

Fig -1: **Final Result**

3. PROGRAMING

Visual Studio is the one of the best tool for programing. Following steps are followed for designing the flange coupling

Step 1 – Integrating Visual Studio with NX 10
Step 2- Creating Form for input parameter
Step 3- Gives Input parameters (Power to be transmitted, Rotational Speed (RPM))
Step 4 - .esc format to .dll format generation
Step 5 – Displayed final assembly on screen

4. CONCLUSIONS

We program for the application for various input parameters and designing conditions and came across the following conclusion, how the customization approach is beneficial to the designing department of the company,

As the saved for the operation the product lifecycle time reduced.

Drawing generation tasks from parametric models become efficient.

Designing cost to the company is reduced.
Reduction in error generation.

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