"Design and Analysis of Injection Mould for Submarine Engine Part (MAD-7503)"

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ABSTRACT

Since few years ago molding process is quite difficult and time taking process. At first Drawing board and then 2D software were used after which patterns were made. But suitable result never gets most of time. So that cost of molding increases and time require for design is more. Due to the technological advancement the process of Mold Design has fastened and also the results are convincing. By using 3D software can create Parametric Design, Which is editable.

In old Design of Mould is done by two step; in first step cylindrical mould is form and then design of grove separately form because this two steps design time get increase as well as manufacturing time also be increase due to two step production done in that initially by injection mould cylindrical part is done and groove is form with help of machine operation.

In this Project design of mould done in such way that optimization in design as well manufacturing and productivity will increase. Two step of product making convert in one step with modification done in mould.

Keyword - *Single stroke mould design, Optimization in design and manufacturing, Increase productivity, Raw material*

1. INTRODUCTION

Injection moulding is an extensive global manufacturing process for making simple to intricate plastic, ceramic and metal parts. Injection moulding converts wax, thermoplastics, thermo sets as well as powdered metals and magnesium into thousands of products. Injection moulding is the most commonly used manufacturing process for the fabrication of plastic parts. A wide variety of products is manufactured using injection moulding, which varies widely in their size, complexity, and application. The injection moulding process requires the use of an injection moulding machine, plastic raw material, and a mould.

Today's competitive environment demands that to survive in the market, entrepreneurs need to ensure that their products get designed and manufactured in the minimum possible time, and at the lowest cost, without

compromising on the quality aspect. This means that Design, Engineering, and Production departments must work together in an integrated fashion. The advent of CAD / CAM has paved the way for a highly flexible, accurate, fast and integrated approach to creating and manufacturing products.

Nowadays, CAD and CAM capabilities are coupled together in a single software package, so as to allow us to transition smoothly from Product Design, Mould design, to CNC Programming and CNC machining. A CAD Software gives us a variety of Creation tools which allow us to proceed in a step by step way, so as to create a 3D representation of the product. These allow the creation of 2D lines, arcs, fillets and wire frames, and then enable us to use these 2D features to build 3D Surfaces or Solids. The primary surfaces created, can further be modified using Modification tools, so as to obtain the final product. Similarly, Moulds i.e. Core and Cavity for these products can also be created using the previously created geometry. Once the product models are ready, the next activity is to get them machined. The products that we see in the markets today are very complex and demand such high quality for surface finish and accuracy, which cannot be obtained by manual machining on conventional machines. We need to use High precision CAM software which gives us the simulation of machining and codes are automatically generated. After the G and M codes generated we send them to VMC Machine for Manufacturing**Eg 2:** It is reported that X increase with Y .

2 INJECTION MOULDING-OVERVIEW

Injection moulding is a manufacturing process for producing parts from both thermoplastic and thermosetting plastic materials. The material is fed into a heated barrel, mixed, and forced into a mould cavity where it cools and hardens to the configuration of the mould cavity. After a product is designed, usually by an industrial designer or an engineer, moulds are made by a (or toolmaker) from metal, usually either steel or aluminum, and precision-machined to form the features of the desired part. Injection moulding is widely used for manufacturing a variety of parts, from the smallest component to entire body panels of cars..

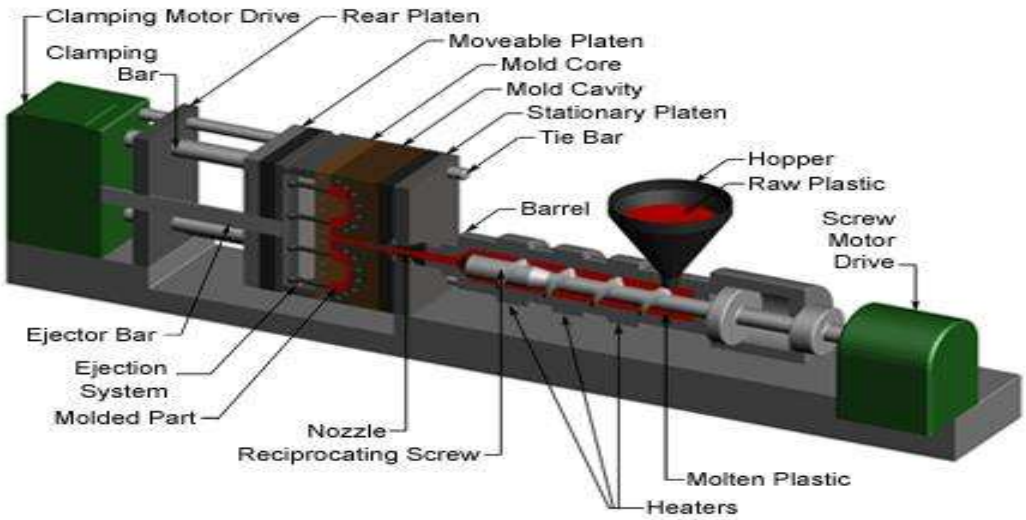

Fig.1 Injection moulding overview

2.1 ANALYSES AND PRODUCTION PERFORMANCE

Analysis Using NX WIZAR

Simulation Modeling and Results Visualization

Reduce the time you spend preparing analysis models, and spend more time evaluating results. Quickly move from multi-CAD geometry data to a complete, run-ready analysis model using unique tools for:

- CAE Geometry Editing
- Comprehensive Meshing
- FE Assembly Management
- Multi-CAE Environments
- Simulation Results Post processing and Reporting Structural Analysis Accurately simulate a wide range of structural analysis problems including:
- Linear and Nonlinear Analysis
- Dynamics
- Durability
- Noise, Vibrations and Harshness (NVH)
- Laminate Composites

Thermal Analysis

Evaluate the thermal characteristics of your products using best-in-class thermal analysis capabilities for:

- Conduction
- Convection
- Conjugate Heat Transfer
- Radiation
- Thermal Modelling

Flow Simulation

Rapidly create fluid domains for complex geometries and perform computational fluid dynamics (CFD) analysis to understand fluid flow effects that influence your product's performance, such as

- Compressible Flow
- Incompressible Flow

- 1D Fluid Networks
- Non-Newtonian Flow
- CFD Modelling

Motion Analysis

Gain more accurate insight into product performance by using real CAD geometry to conduct multi body dynamic simulation, including capabilities for:

- Rigid Bodies
- Flexible Bodies
- Interference Checking
- Co-simulation with Control Systems

Engineering Optimization

Reduce component weight or find the right combination of parameters to improve product performance through comprehensive optimization capabilities, such as:

- Geometry Optimization
- FE Parameter Optimization

Simulation-Driven Design

Give your designers the ability to validate rapidly and iterate their designs using the same simulation technology you trust. Configure the user, interface and deploy scalable solutions to fit different levels of expertise.

- Customizable User Interface
- CAE Automation
- Design Validation
- Interference Checking

Analysis of part:

Analysis for Max. Cooling Time

This Analysis is done for maximum cooling Time require for norly material after injection done. By analysis, it's observed that max. Cooling time for mold is around 46 sec.

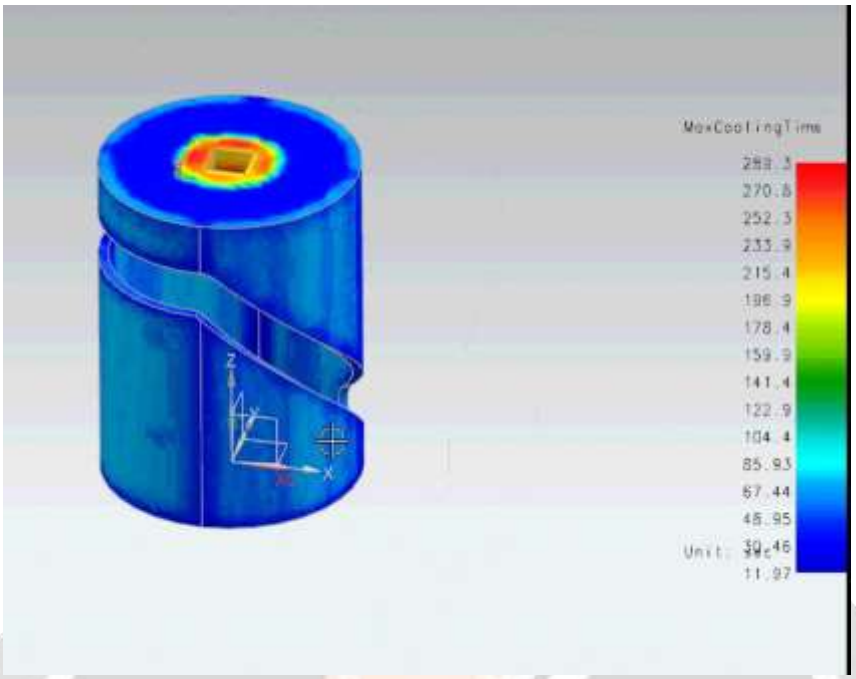

Fig.2 Max. Cooling Time for mold

At the top of part, cooling takes late because of the complex part, and also it's near to injection point.

Analysis for a Pressure Drop

Pressure Drop is the important parameter to avoid cavitation in the cavity; since the high pressure drop its means that cavitation gets void. Because of cavitation bubble formation will act so cavity does not fill with the material because the presence of bubble.

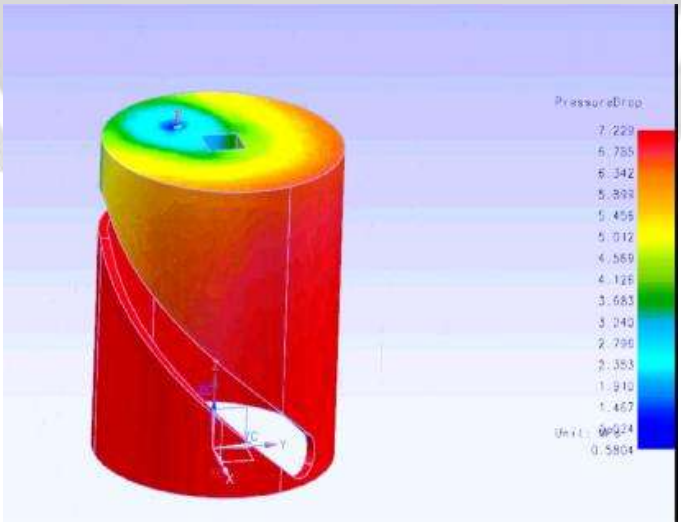

Fig.3 Pressure drop for mold

By Analysis it's clear that pressure will drop up to 7 to 6.5 bar and this pressure drop must be maintained to avoid cavitation.

Analysis of maximum temperature presents in mold

Temperature is the most important parameter for injection molding .because of the low temperature of mold it's possible that some part of mold solidified early than other part, and the defect will form in mould part. For that purpose it's essential that temperature of mold everywhere is same it's always up to melting temperature of mold material.

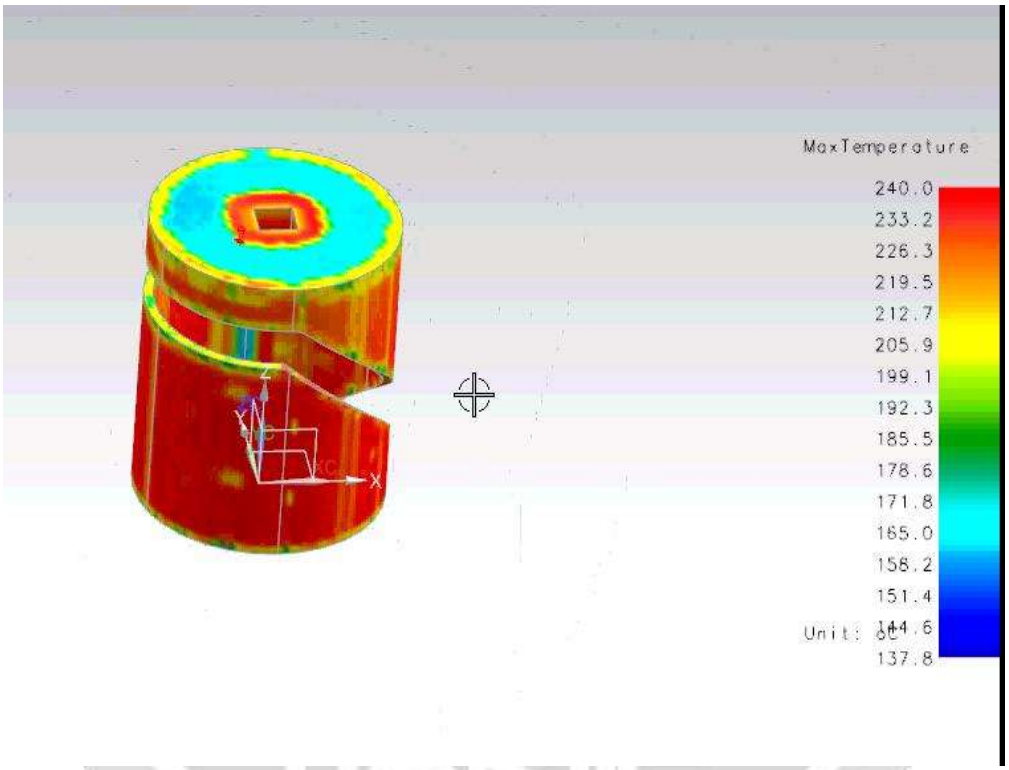

Fig.4 Manufacturing Using Delcam (Power MILL)

Power MILL is a 3D CAM (Computer-aided manufacturing) solution that runs on Microsoft Windows for the programming of tool paths for 2 to 5 axis CNC (Computer Numerical Control) Milling machines developed by Delcam Plc. The software is used in a range of different engineering industries to determine optimal tool paths to reduce time and manufacturing costs as well as reduce tool loads and produce smooth surface finishes. More than 15,000 organizations use Power MILL worldwide for 2, 3 and 5-axis machining.

Advantages of 3D CAD Technology in Mould Design

- Heavy Reduction in Design Time
- Reduction in Design Cost in Long-term
- Optimization in Designing

- We can work out multiple options and chose the efficient one.
- Better Visualization of objects before actual production
- As the standard part library is available, it is not needed to design every part.
- Core Cavity can be extracted easily
- Mould Drawings can be easily done using the standard templates.
- Mould Flow Analysis makes it easy to judge the flow of material in the mould.

Limitation of 3D CAD Technology in Mould Design

- All these modern technologies are expensive.
- Skilled manpower is not easily available.
- Modern machines required for this technique are available at high cost.
- 3D software's are costly.

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3. CONCLUSIONS

On Basis of Result, it can be concluded that

- Optimize in Mould Design and manufacturing process
- Heavy Reduction in Design Time, Design Cost in Long-term From this new design of mould get following results-
- Increase in quality of product.
- Production cost per unit decreased.
- Increase in profit.
- Material saving.
- Fulfill the need of company

4. FUTURE SCOPES

1) New design technique reduce so much complications on basis of that, In single injection shot two product may be make so that production rate get double.

2) Try to minimize cooling time of mould part after injection.

5. REFERENCES

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