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Modelling and Analysis of Collapsible Core

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Abstract— Those for larger pipes are custom designed. The objective of this research was to fully automate the design procedure which, for PVC pipe fittings is laborious and error prone at present. This paper discuses the design of the four key geometrical features of a two stage, lever-actuated collapsible core namely, the number of segments during demoulding, the minimum angle of taper of the grooved undercut to permit the segments to retract during demoulding and the preventation of interference between moving components. After the key geometrical features are established, it is the possible to fully automate the design of two- stage, lever-actuated collapsible core in a CAD system. The time required to design these moulding tools has been drastically reduced in the plastic injection moulding company with whom this research was jointly undertaken. And mainly we designed this product in PRO- E software. At the time of manufacturing process also we are doing in the industry of spy reddy Nandi pipes product. So this is called as multi usage product. This is a two stage collapsible core for injection moulded plastic parts with internally.

Keywords— collapsible core, undercutsplastic injection moulding.

I. INTRODUCTION

Producing plastics parts with undercuts presents distinct challenges for molders. Undercuts are protrusions or recessions in a part that prevent the mold, after the part is formed, from sliding away along the parting direction. These features inhibit the direct removal of the core, and as a result, generally necessitate using an additional mold piece, such as a side-core or an internal core lifter, to form the shape.Undercut designs are often used to create threaded parts, such as screw-on bottle caps, snap-on products such as lipstick containers, and a variety of consumer, medical, automotive, and other products. Threaded caps illustrate well the complexities associated with undercuts. After the cap is formed, the threads of the part and the threads of the core are intermeshed and must be disengaged before the core can be pulled out and the cap removed from the mold. Molders have developed a variety of methods for molding undercut or threaded parts—some as simple as unscrewing the part by hand or machining the undercuts in a separate operation—that range widely in cost-effectiveness and efficiency. This article will present some of the recent technology advancements that give molders better, more cost-efficient methods of producing undercut or threaded parts. Although PRO E systems were used as me re drafting tools in injection mould de sign during their early days, they have developed to a stage where they can be used to automate some of the design activities. For example , knowledge-based systems with either a graphical interface or merged with solid modelers, have been developed to carry out certain repetitive tasks in the design of injection moulds, such as selecting appropriate mould plate dimensions. These systems, however, are mainly restricted to the automated selection of standard components such as the guide pins, locating ring, etc., for relatively simple plastic products. Mould design is, however, still not fully automated. As plastic products become more compel in shape, features such as undercuts are common place. Examples of undercuts are threads, groove s, cut-outs, etc. These undercuts obstruct the removal of the moulded plastic product along the direction in which the mould opens, and so moulding tools for undercuts have often to be custom-designed. Some CAD related algorithms have been developed to automate the de sign of common moulding tools for undercuts such as the side core and the side cavity). The side core and side cavity cannot be used to form continuous internal undercuts in, say, plastic pipe fittings. Since there is a dearth of de sign knowledge of moulding tools for internal undercutssome of the parameters have to be determined by trial-and-error. Heuristic knowledge must often be distilled from existing designs and formalized into more rigorous mathematical relationships before the design of the moulding tool can be compute r-automated. This paper discusses a functional approach to the de sign of moulding tools for internal undercuts of pipe fittings, based on both heuristic and compiled knowledge

Fig1.Diagram of collapsible core

II. WORKING OF COLLAPSIBLE CORE

Dovetail collapsible cores provide the most compact and simplest way to mold challenging internal undercut features. With a mechanical means for collapsing segments, the Dovetail core has added versatility to handle a larger range of diameters and undercut depths. Molders sometimes hesitate to use standard collapsible cores in part because the product’s design uses steel flexing segments that are all integral to each other. If, for example, a machine clamps up on a part, the segments of the conventional collapsible core may be damaged or broken. Although the root cause is improper molding operation or mold design, this type of error creates an undeserved negative reputation for flexing steel collapsing cores.

Because of their strength, dovetail joints are commonly used to lock components together in wood working and other industries. Similarly, Dovetail collapsible cores are much stronger than their conventional counterparts. Standard collapsible cores use a tube of steel slotted into 12 individual segments, while the Dovetail uses six independent segments, which are larger, stronger, and easily repaired if necessary. Conventional collapsible cores work well in the B-half of the mold but can create design issues in the A-half. The segmented design of the Dovetail enables it to work equally well in either half of the mold. This means a molder can use fewer, smaller mold plates and a smaller molding machine for higher cost savings.

Dovetail collapsible cores also enable shutoffs, both front and side. This is a major advantage for mold makers compared with conventional collapsible cores, which often require part-design modifications to deal with collapsing segments or mold shutoffs. However, both styles of collapsible cores can be used to mold protrusions or cut-outs into the side wall of a part.Straight forward actuation of the Dovetail collapsible core enables manufacturers to design and build a mold that requires only “mold open/mold shut” commands to operate. In most cases, there is no need for special core-pull circuits or even the common ejector-plate sequence. The potential cycle-time reduction is enormous. Dovetail collapsible cores also incorporate a patent-pending quick-lock system that enables molders to quickly remove the assembly from the mold without removing the mold from the machine.

Another prominent benefit of Dovetail design is that mold makers can use a standard fixture to grind the thread onto the outer diameter of the core. This isn’t an option with conventional versions, which require a mold builder to either buy or build a special grinding ring.

Undercut parts present many challenges to designers and molders, but technology is always evolving to meet them. While some methods for molding undercuts are tried and true, they might not always provide the cost savings or efficiencies of more advanced technologies. Dovetail collapsible cores have proven to be a great solution for a variety of applications – improving cycle time, cost savings and reliability.

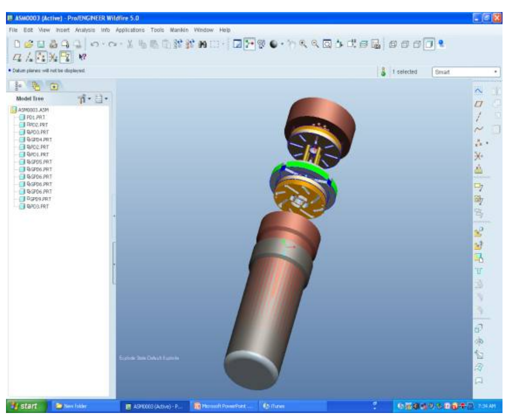

Fig 2: Diagram of Working Process of collapsible core

The collapsible core is designed to collapse independently when the center pin is withdrawn. The fit between segments is controlled to permit flash-free molding, which means the location of the core on its pin is critical. The distance between the back of the core flange and the front of the center-pin flange, known as head space, must be precisely maintained. Otherwise, inaccuracies in head space will produce unsatisfactory operation and possibly cause permanent damage to the core.

The collapsible core is designed to operate without benefit of lubrication. While it’s possible to treat the core with an alloying process for wear reduction and corrosion resistance, plating the core is not recommended.

The individual segments of the collapsible core have a self-cleaning action that will tend to carry any dirt or deposits to the outer surface of the collapsing core. As a result, the first 50 to 100 shots may show foreign matter deposits on the inside of the molded part. Prior to final assembly of the mold, the core should be thoroughly degreased and cleaned. It’s usually a good idea to lightly

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wipe the tapered end of the center pin with grease or PTFE lubricant to help break it in.

III. INTRODUCTION TO PRO-E

PRO-E mechanical design solution will improve our design productivity. PRO-E is a suit of programs that are used in design, analysis and manufacturing of a virtually unlimited range of the product. "Solid modeling" means that the computer model we create is able to contain all the information that a real solid object would have. It has volumes and therefore, if you provide a value for the density of the material it has mass and inertia.

A. Modules In PRO-E

Following are the important module of PRO-E:
Sketch Module
Part module
Geometric modeling

B. Modeling Procedure

Open creo 2.0 software. As you open the cero 2.0 a definition box will appear which represents the following modules.
Sketcher
Part
Sheet metal
Assembly
Drawing(drafting)
Now select the part module and deselect the default templates and select the required measurements in mm or in lbs mostly mm is preferred. Now select the part module and select the measurements in which you want. Thus part module is opened with planes representing at the centre. Select the required plane and go to sketcher module so as to draw the sketch
Generally there are two types of profile we create in sketch

Open profiles:-These are generally preferred in surfaces
Closed profile:-There are preferred in part module. The short dripper design modeling is done in Pro-e by using operations like revolve, extrude, mirror, project, remove etc.
1) Revolve: Use: To Add or remove material in counter clockwise direction.
Procedure: Revolve -- Placement – Select the sketch plane – Create the center line –Draw the required sketch—Mention the angle -- Preview – Ok

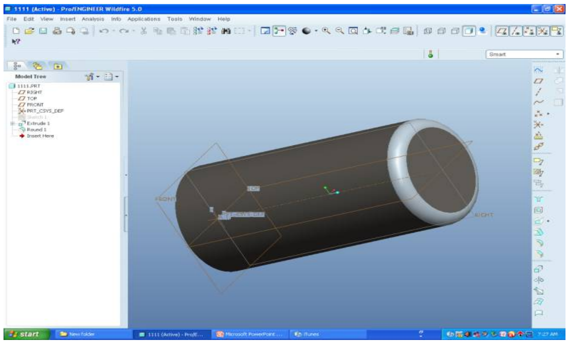

Fig: 1.1 The above diagram represent the revolve operations.

2) Mirror: USE: To create the duplicate object with reference to datum plane or flat surface
Procedure: Select the object – Select mirror tool which is highlighted – Select the reference plane or surface -- Preview -- Ok.

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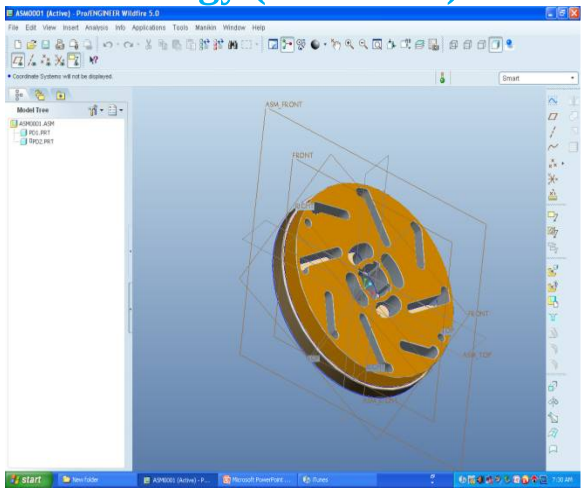

Fig: 1.2The above diagram represents mirroring of a plane into another plane.

3) Project: The project parameter is used to reflect the sketch on to the plane which we want to project.

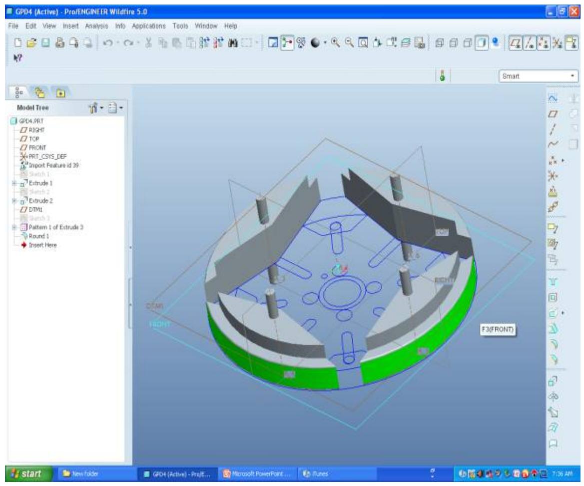

Fig: 1.3 Then if we go to sketch the design which is projected will be shown in below figure

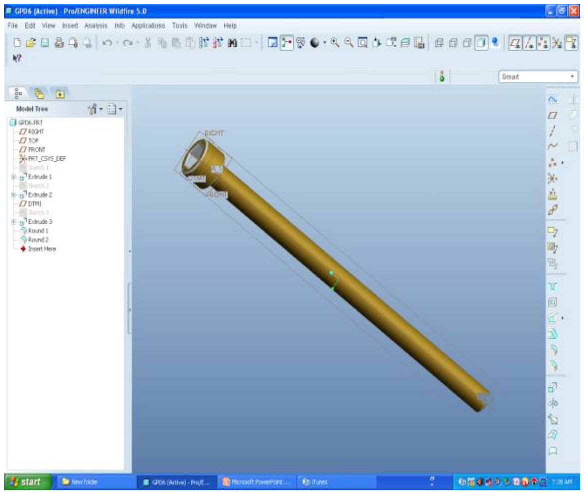

Fig: 1.4

4) Remove: The name itself indicates that removal of material. This is used to remove material wherever it is necessary.

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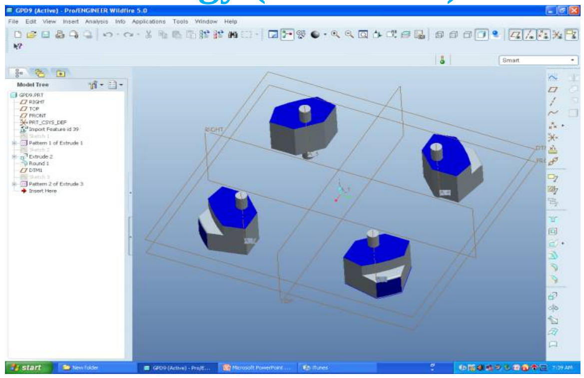


Fig: 1.5 Then if we go to sketch the required object is found.

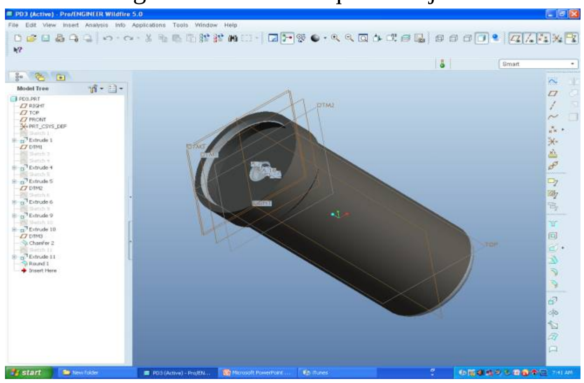
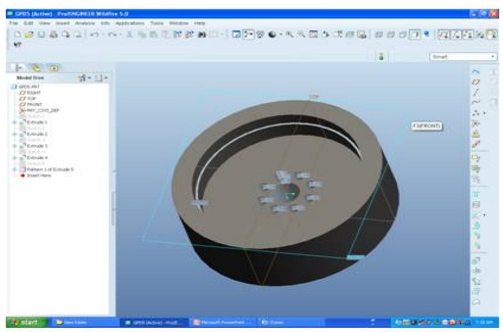


Fig: 1.6

5) Extrude: To add or remove material in orthogonal direction.
Procedure: Extrude -- Placement – Selection of sketch plane – Draw the sketch – Mention the depth -- Preview – Ok.



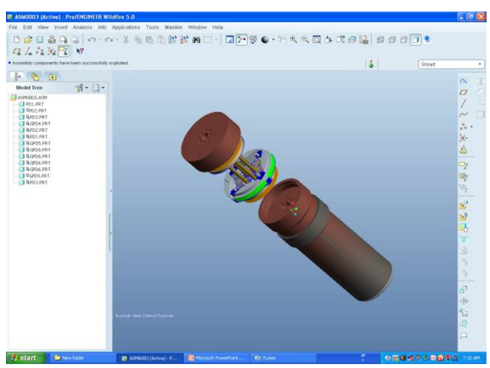


Fig: 1.8 - final component

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IV. INTRODUCTION TO ANSYS

ANSYS, Inc. is engineering simulation software it was developed in Pittsburgh Pennsylvania, United States. ANSYS was listed on the NASDAQ stock exchange in 1996. In late 2011, ANSYS received the highest possible score on its Smart Select Composite Ratings according to Investor's Business Daily.[5] The organization reinvests 15 percent of its reinvests 15 percent of its revenues each year into research to continually refine the software.

There are mainly three types of analysis

Structural Analysis

Thermal Analysis

Fluid Analysis

In this project static structural analysis is done. This of two types one is before modification and another is after modification.

A. Static Structural Analysis: (Before Modification)

Double click on the Static Structural it opens Ansys Mechanical Window. This window contains many tools to do the analysis. In order to find total deformation and equivalent stress we have to first apply mesh, fix the model next and apply pressure.

Solution:

1) Total Deformation: The total deformation is 0.00032473 mm, which is very low as compared to the body size.

2) Equivalent Stress: The stress obtained is 5.6301 Mpa, which is very low as compared to the yield strength of the material.

B. Static Structural Analysis: (After Modification)

The process is same for short dripper also that is after modification. Hence the solution is as follows. The total deformation is 0.00021165 mm, which is very low as compared to the body size. The stress obtained is 3.9764 Mpa, which is very low as compared to the yield strength of the material.

V. CONCLUSION

A design prototype was constructed to automate the design of a, lever-actuated collapsible core for moulding UPVC pipe fittings with an internal groove. A functional approach was adopted to reason about the function of a collapsible core and then to decompose its de sign into its function, behaviour and structure. The number, orientation, placement and dimensions of the components that make up the collapsible core and which satisfy the functions and behaviours are computed. The structure of the de sign prototype can be re -formulated for different UPVC pipe size s, but retaining the same function and behaviour, thereby completely automating the de sign of collapsible core s for UPVC pipe size s ranging from 100 to 350 mm in diameter. The de sign prototype was implemented in the UniGraphics II system. The mould de signer in industry now takes twenty minute s to de sign a collapsible core , when formerly an average of four months was needed to complete the de sign by semi-automated, trial-and error means

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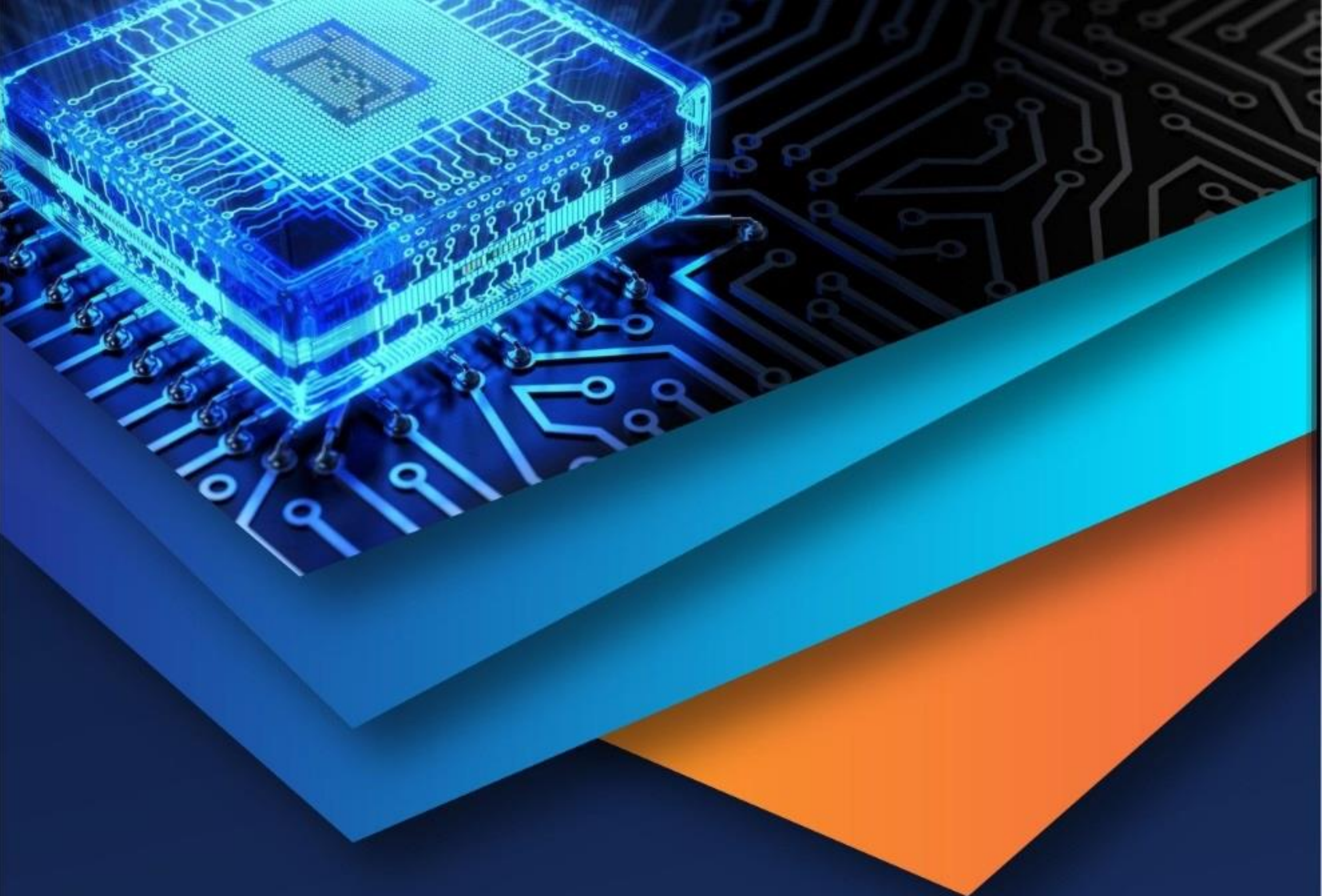

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