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DESIGN OF FIXTURE AND ANALYSIS OF RUNNER SYSTEM IN PLASTIC INJECTION MOLDING

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Abstract - *The main aim of our project is to reduce the time consumption and wastage of plastics in plastic injection molding of JACK END CAP. For this we have designed a fixture which is used fix the terminal into the product. This will reduce the production time and also it will help the worker to do the work with safety. In plastic injection molding currently partial hot runner system is being used which will reduce the wastage of material. For normal plastic injection molding most of the industries are using cold runner system. The main drawback in cold runner system is high wastage. By using partial hot runner high wastage will be reduced. Because, in partial hot runner the runner path way will be kept in molten state. So the wastage will be reduced and also it will increase the production rate.*

Keywords- *Reduction of wastages, plastic injection molding, runner systems, thermal analysis*

I. INTRODUCTION

Manufacturing is the backbone of any industrialized nation. Manufacturing and technical staff in industry must know the various manufacturing processes, materials being processed, tools and equipment for manufacturing different components or products with optimal process plan using proper precautions and specified safety rules to avoid accidents. Manufacturing is the use of machines, tools and labour to produce goods for use or sale. Manufacturing takes turns under all types of economic systems. In a free market economy, manufacturing is usually directed toward the mass production of products for sale to consumers at a profit.

II. OBJECTIVE

- To design the fixture for plastic injection molding machine.
- To increase the production rate and reduce the time consumption.

A fixture is a work-holding or support device used in the manufacturing industry. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a work piece during either a machining operation or some other industrial process. Fixtures are important in both traditional manufacturing and modern flexible manufacturing system which directly affect manufacturing quality, productivity, and cost of product.

III. LITERATURE SURVEY

- Jonathan "Rundle" Bacon created them in the 19th century, rocker arms have been made with and without "rundle" roller tips that depress upon the valve, as well as many lightweight and high strength alloys and bearing configurations for the fulcrum, striving to increase the RPM limits higher and higher for high performance applications, eventually lending the benefits of these race bred technologies to more high-end production vehicles.

- Even the design aspects of the rocker arm's geometry has been studied and changed to maximize the cam information exchange to the valve which the rocker arm imposes, as set forth by the Miller US Patent, #4,365,785, issued on December 28, 1982, often referred to as the MID-LIFT Patent. Previously, the specific pivot points with rocker arm design was based on older and less efficient theories of over-arching motion which increased wear on valve tips, valve guides and other valve train components, besides diluting the effective cam lobe information as it was transferred through the rocker arm's motion to the valve.

- According to Fred H Colvin, a jig or fixture is any device that guides drills or other tools so as to produce work that is interchangeable within the tolerances set by manufacturing requirements. The same terms are also used for devices or frames that hold pieces in their proper position while being welded, or otherwise joined together.

- We are, however, most interested in devices for holding work during various machining operations, and jigs and fixtures of this class will receive the greatest attention. A distinguishing definition for jigs and fixtures that seems to be generally accepted is about as follows:

- A jig is a work-holding, device which is not fastened to the machine on which it is used. A fixture is also a work-holding device but one that is bolted or otherwise fastened to the machine. The jig, for example may be moved around on the table of a drill press to bring each bushing under the drill spindle.

- A fixture, on the other hand, is fastened to the table or base of a machine and either the tool is moved to the point of operation, as in the case of a radial drill; or the table is moved under the cutting tools, as in a milling machine. This definition, however, has not been officially standardized.

- The New Standard Dictionary (1952) defines jig/fixture as; A fixture is a device, constituting an essential element of a machine, which holds in position either the work or the tool acting on the work. A fixture in serving its purpose is generally dependent upon the action of the machine of which it is a part, while the jig is not.

IV. INTRODUCTION TO FIXTURE DESIGN

Fixtures must correctly locate a work piece in a given orientation with respect to a cutting tool or measuring device, or with respect to another component, as for instance in assembly or welding. Such location must be invariant in the sense that the devices must clamp and secure the work piece in that location for the particular processing operation. Fixtures are normally designed for a definite operation to process a specific work piece and are designed and manufactured individually. Jigs are similar to fixtures, but they not only locate and hold the part but also guide the cutting tools in drilling and boring operations. These work holding devices are collectively known as jigs and fixtures.

4.1 Types of fixture

a) Plate Fixture

Plate fixtures are the simplest form of fixture. The basic fixture is made from a flat plate that has a variety of clamps and locators to hold and locate the part. The simplicity of this fixture makes it useful for most machining operations. The plate fixture is shown in below figure.1

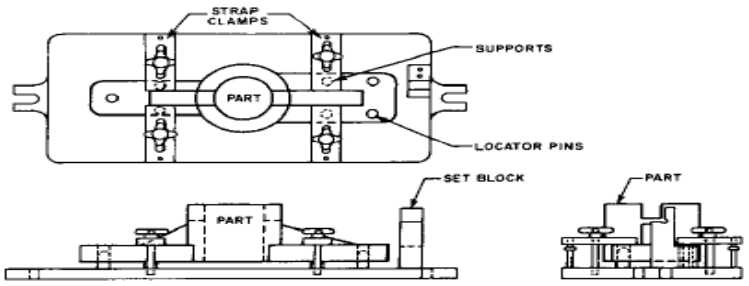
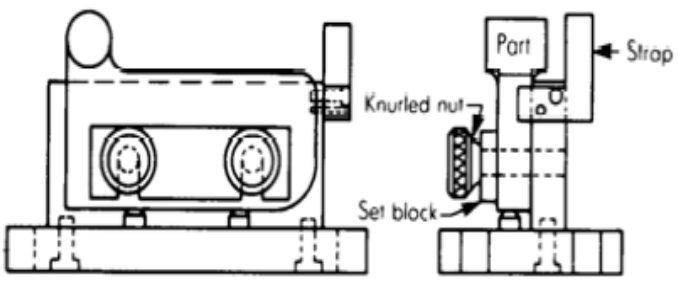


Plate fixture

b) Angle Plate Fixture

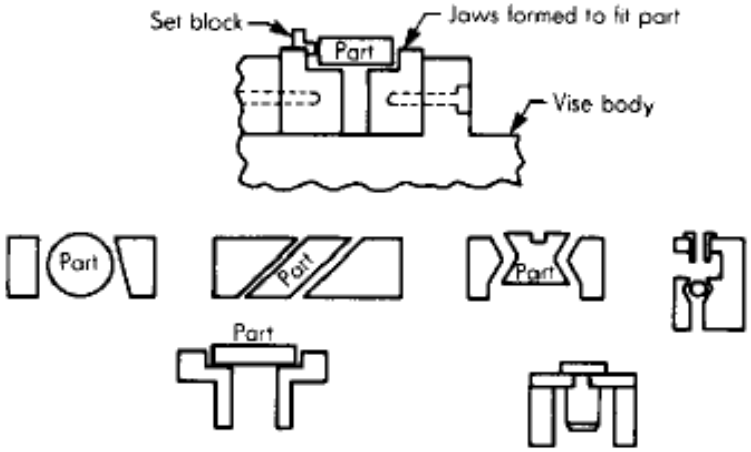
The angle-plate fixture is a variation of the plate fixture .With this tool, the part is normally machined at a right angle to its locator. While most angle-plate fixtures are made at 90 degrees, there are times when other angles are needed. The Angle plate fixture is shown in below figure 3.2

Angle plate fixture



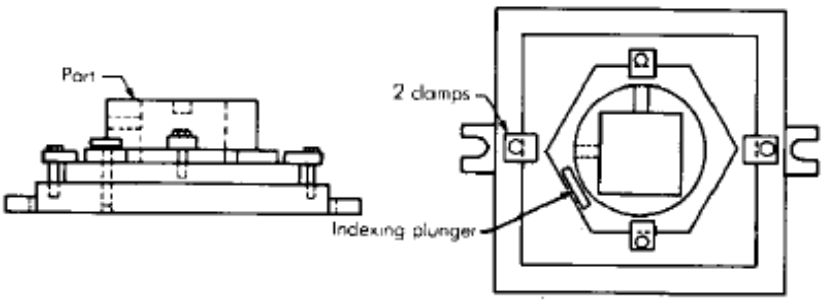
c) Vice-jaw Fixtures

Vise-jaw fixtures are used for machining small parts .With this type of tool, the standard vise jaws are replaced with jaws that are formed to fit the part. Vise-jaw fixtures are the least expensive type of fixture to make. Their use is limited only by the sizes of the vises available. The Vice-Jaw fixture is shown in below figure 3.3



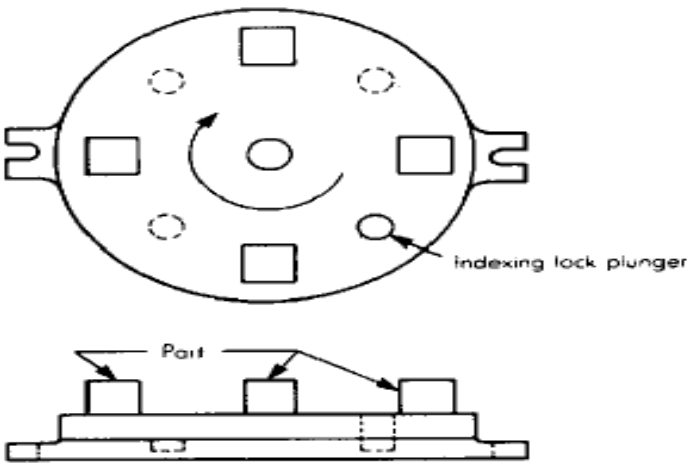
d) Indexing Fixtures

Indexing fixtures are very similar to indexing jigs. These fixtures are used for machining parts that must have machined details evenly spaced. The indexing fixture is shown in below figure 3.4



e) Multi-station Fixtures

Multi-station fixtures are used primarily for high-speed, high-volume production runs, where the machining cycle must be continuous. Duplex fixtures are the simplest form of multi-station fixture, using only two stations. This form allows the loading and unloading operations to be performed while the machining operation is in progress. The multi-station fixture is shown in below figure 3.5



4.2 Elements of fixtures

- MS. Base
- Clamps
- SUPPORTS
- FIXTURE BODY

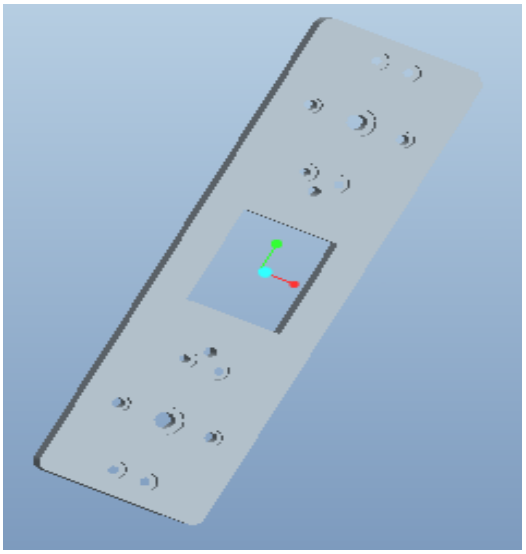
4.3 **considerations in design of fixtures**

Designing of fixture depends upon so many factors. These factors are analyzed to get design inputs for fixture. The lists of such factors are mentioned below

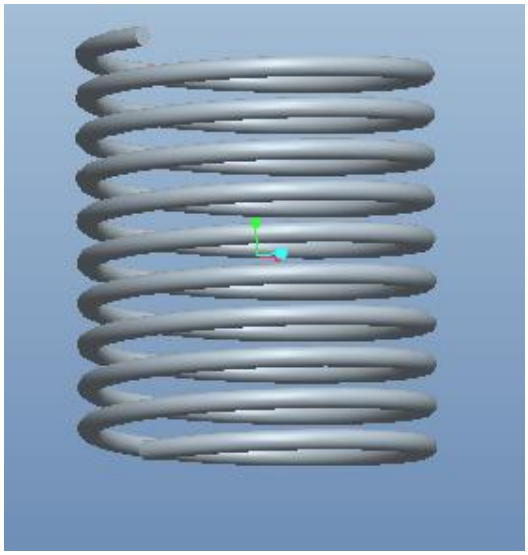
- Study of work piece and finished component size and geometry.
- Type and capacity of machine, its extent of automation.
- Provision of locating devices in the machine.
- Available clamping arrangements in the machine.
- Rigidity and of the machine tool under considerations.
- Study of ejecting and safety devices.

V. MODELLING OF FIXTURE

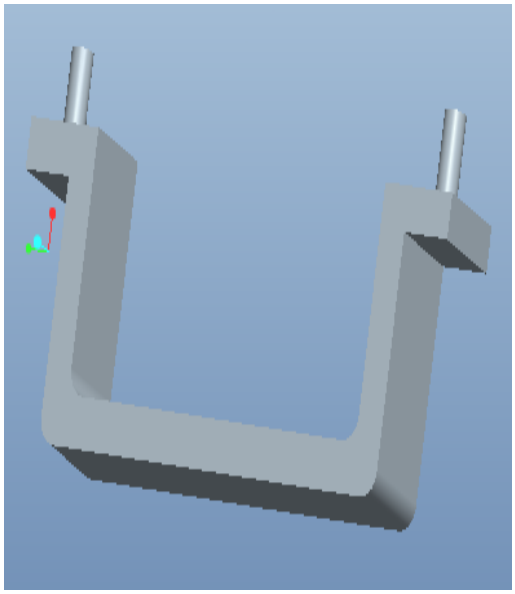
BASE PLATE



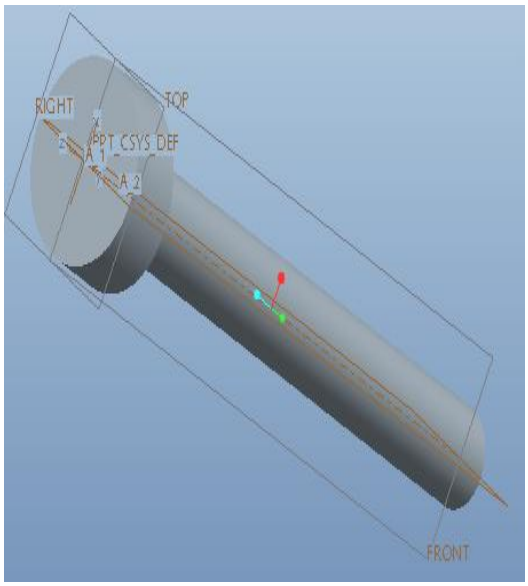
SPRING



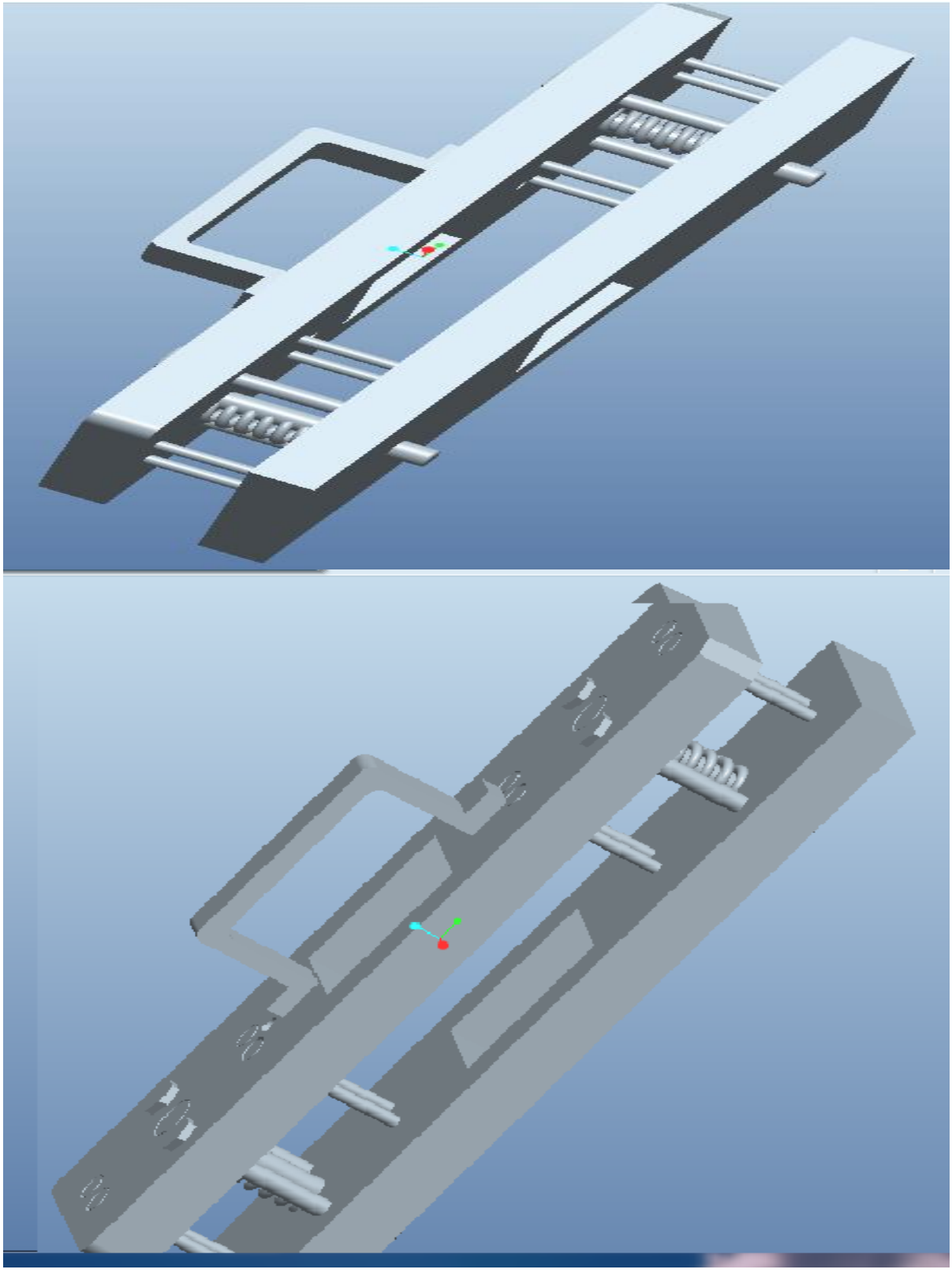
HANDLE



EJECTOR PIN



FIXTURE ASSEMBLY MODEL



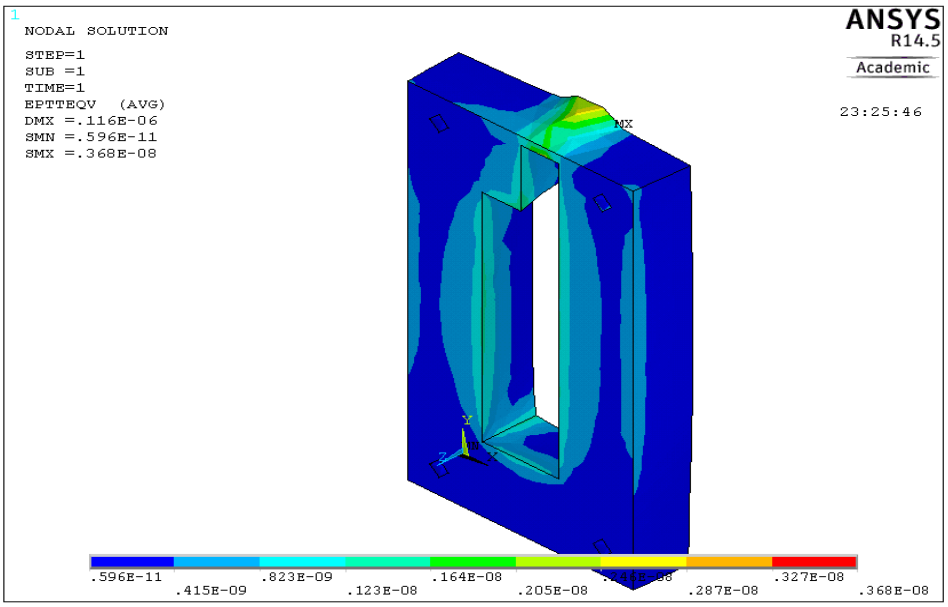
VI. ANALYSIS OF SEMI HOT RUNNER MANIFOLD PLATE IN INJECTION MOULDING

Analysis of manifold plate is done by ANSYS. From these analyses we can get all type of strength test results by applying required data. With proper modeling and load applied as per given data the analysis results to be determined. These forces have to be considered in the mechanical layout of the mold and hot runner. Insufficient mold strength will cause melt leakage in the hot runner and flashing of the part. Mechanical stability calculations through methods such as finite element analysis can be made.

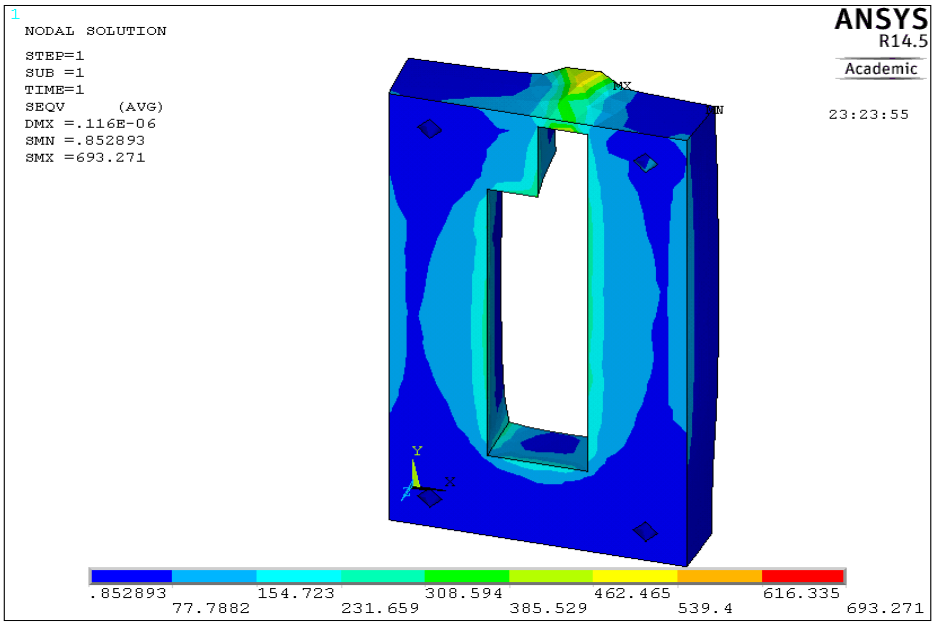
6.1 Properties and dimensions for analysis

Material of manifold plate – steel
Size of plate – 246x446x60 mm
Temperature of mold – 70-80c
Mold plastic pressure – 80 bar(for all plates)
Nozzle velocity – 115 cubic cm

6.2 THERMAL STRESS ANALYSIS OF MANIFOLD PLATE



6.3 VON MISES STRESS RESULTS



VII. CONCLUSION

Design of fixture and analysis of runner system for plastic injection molding has done .The design was analysed and found the results to be satisfactory. Due to this the production rate is increased. Thus by our design the rate of productivity is increased and the time consumption is reduced and also the design is more comfortable and safe. And also we have analyzed the partial hot runner system. This is a very efficient method, because this will reduce lot of wastages and also it will increase the productivity. By using partial hot runner setup we can two more products when compared to cold runner system. Thus by using partial hot runner setup the cost is reduced and also it increased the productivity.

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