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THE CONVENTIONAL EXTRACTION OF FEATURES FROM INTRICATE PRISMATIC PART FOR COMPUTER AIDED PROCESS PLANNING SYSTEM (CAPPS)

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ABSTRACT

The basic object of this paper is conventional study, identification and development of machining feature from prismatic component. The extraction of features plays an essential mission in the Computer Aided Process Planning [CAPP] System. The extraction of feature attain firstly, by study of the geometrical specification from given CAD model drawing. Secondly, by characterizing the different features according to their machining shape and reflecting characteristics of the machining process from the viewpoint of the removal volume.

The efficient extraction of feature ultimately helps in grouping the machined areas into clusters, where each cluster can be matched to a machining feature. In this paper the conventional method of key techniques such as feature recognition and conversion, feature parameter and constraint extraction, volume approach, feature tree construction, information processing, sequence of the optimized process planning by considering 2.5 Dimensional stock and CAD model as input.

KEYWORDS: Prismatic Component, Computer Aided Process Planning, Computer Aided Design, Machining Feature Extraction, Machining Process Model and Sequence of Operation Tree

INTRODUCTION

The economical manufacturing of a components depend on appropriate sequencing of optimizing techniques in terms of selection of material, process, tools, machining operation, cutting parameters. In the recent globalized competitive market a high demand on quality, cost reduction, reliability, serviceability, large-variety customized production and increasing attention being paid to shortening product development life cycles[SPDLC] ***[Molina et al. 2005; Zheng et al. 2008].***

Therefore, it is almost imperative to incorporate manufacturing considerations in new product design since primary manufacturing costs are determined in the design phase. Computer Aided Design (CAD) and Computer Aided [Assisted] Manufacturing play a key to accomplish critical tasks depends on their effective integration. The significance of CAD/CAPP integration arises from the fact that CAPP relies on the product model data provided by CAD to perform precise and consistent process planning for manufacturing.

However, they tend to have different product data descriptions, i.e. CAD is usually geometry-based, whilst CAPP/CAM are feature-based and domain-dependent, which results in unsatisfactory practical implementation, or a common weakness of CAPP systems — they usually act as stand-alone functions and do not have a link with either CAD or CAM systems. ***[Xionghui Zhou_, Yanjie Qiu, Guangru Hua, Huifeng Wang, Xueyu Ruan, 2007].***

But most of the current CAD and CAM are not able to support a communication with each other due to reprehensible programming and failing in translation of precise design specification into machine understandable form. The Computer Aided Process Planning [CAPP] plays a major bridge role in between CAD and CAM. A Computer-Aided Process Planning (CAPP) system offers the potential for reducing the routine clerical work of manufacturing engineers. At the same time, it provides the opportunity to generate production routings, which are rotational or prismatic. The application of feature-based process planning has gained ground recently in supporting the efficient CAD and CAM integration **(Gao et al. 2004; Zhou et al. 2007).**

Features are assumed inherently as a main factor in such an integration effort because of the association of various designs, engineering and manufacturing data used by CAPP **(Liu and Wang 2007; Tanaka and Kishinami 1998; Wang et al. 2006).** Proper sequencing of machining features still remains a challenging issue in CAPP due to its complexity and adherence to the class of nondeterministic polynomial problems **(Mokhtar and Xu 2011).**

APPROACH TO EXTRACT MACHINING FEATURES

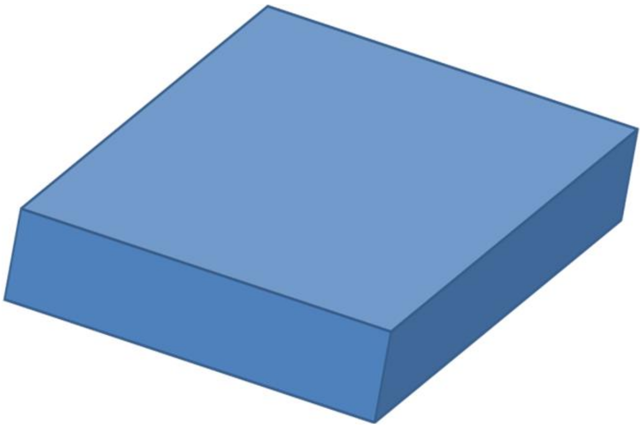


Figure 1: Stock of 100mmX400mmX600mm

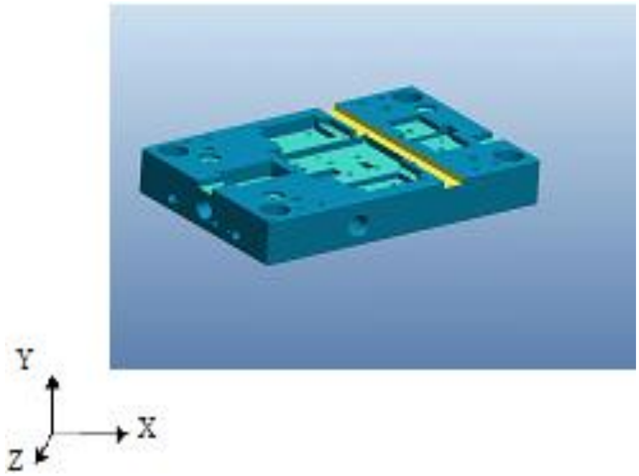


Figure 2: A Model Prismatic Part

In this paper the extraction of feature has been accomplished by using the volume approach method. The volume approach uses the machined volumes from a rough part model. In this part some of features are large volumes so that the amount of material should be removed from the rough part model must be large. This kind of material removal volumes have significant meaning in CAPP because, the volume approach would be more desirable to represent machining features, due to that process planner need to carefully consider the amount of material removal volumes to determine how many and what kinds of machining operations should be applied to the stock.

Care has been taken that the volume difference between the rough part model and the final part model is relatively small and even and totally near net shape. The machined areas from the final part model provide better information for process planning than the material removal volumes.

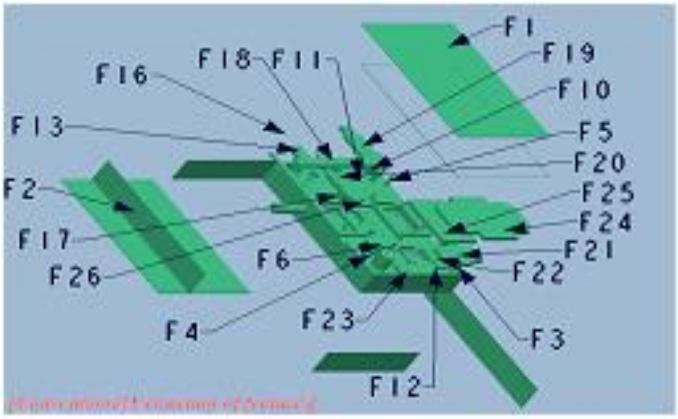


Figure 3: Conventional Extraction of Machining Features

DIMENSIONING TO EACH FEATURE

Step 1: Extraction of feature starts with F1 and the family F1 consists of F2, F3, F4, F5, F6, F8, F9, F10, F11 and F12 sub families.

F1 of the entire block will be cut first with dimensions of 3X400X600

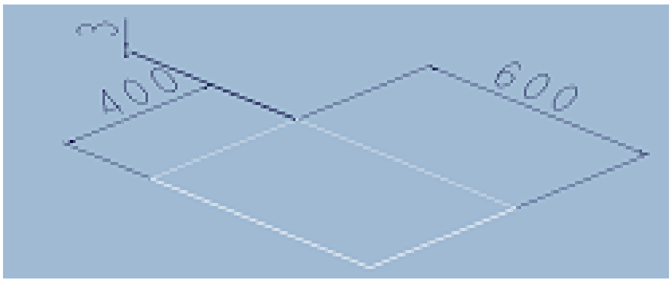


Figure 4: Machining Feature 1

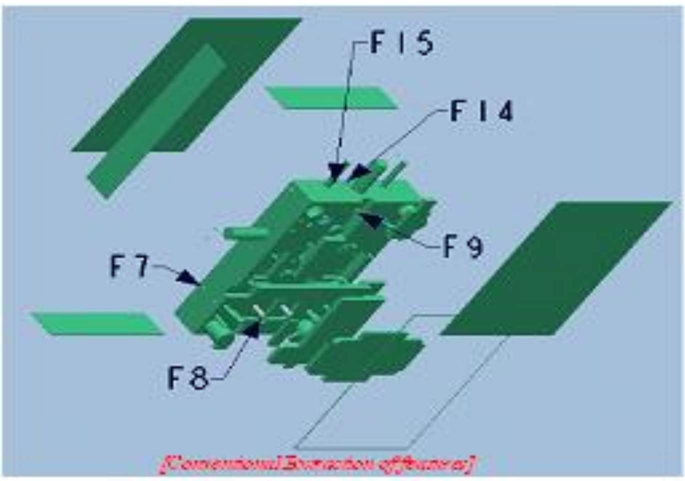


Figure 5: Conventional Extraction of Features by Volume Based Approach

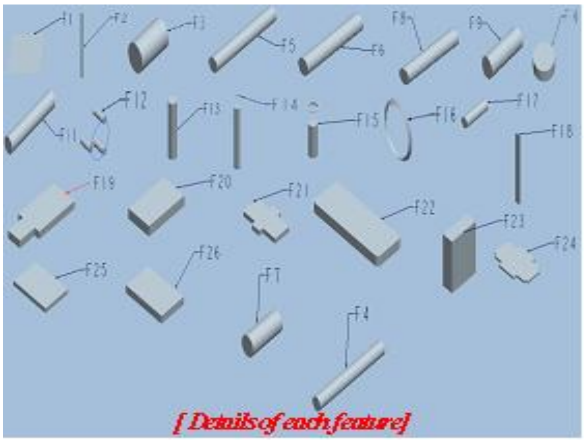
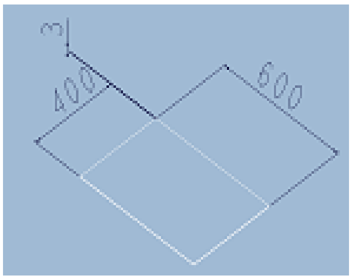


Figure 6: Each Feature Dimensions for Writing Algorithms



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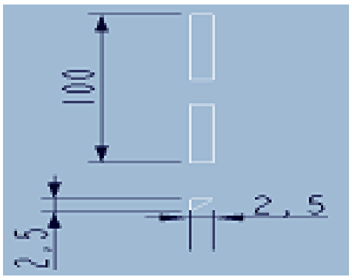

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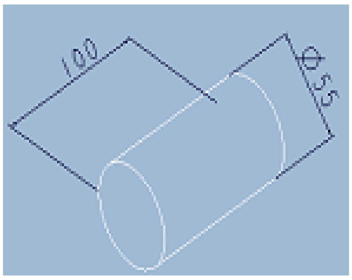

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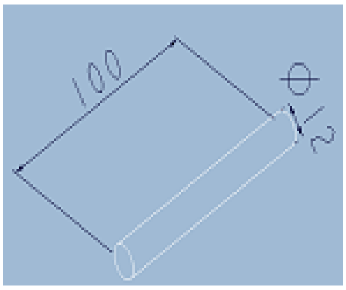

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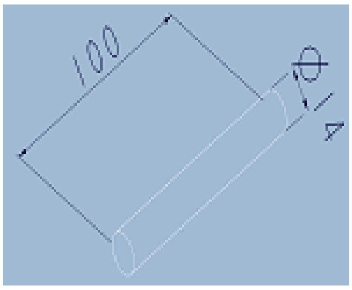

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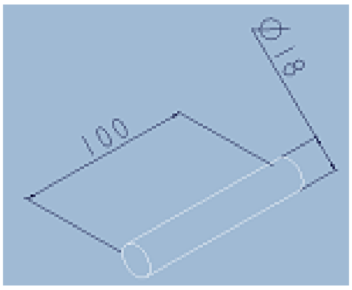

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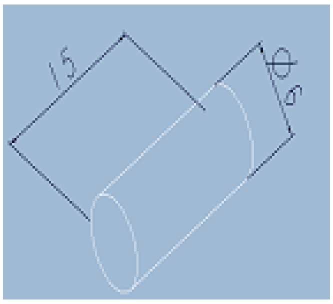

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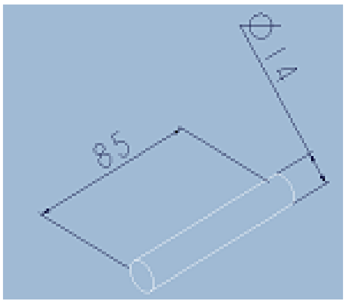

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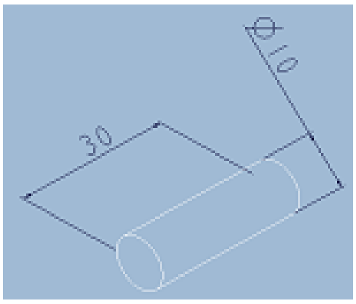

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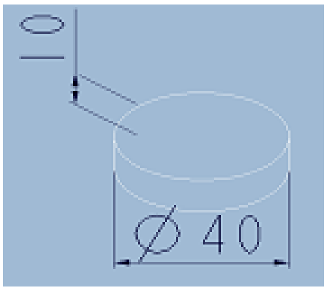

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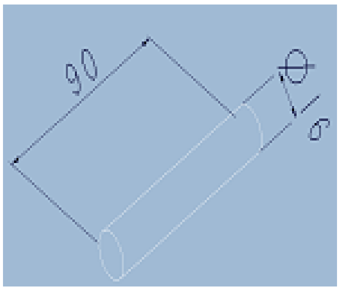

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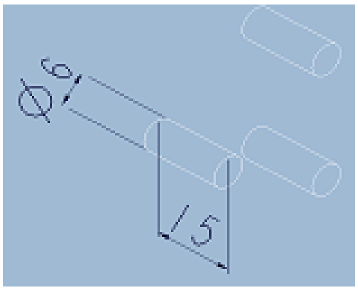

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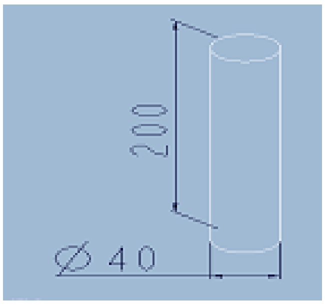

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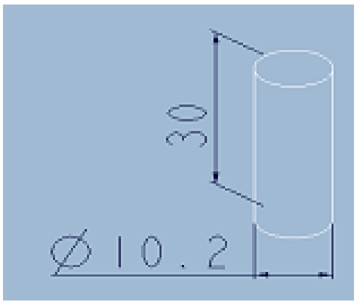

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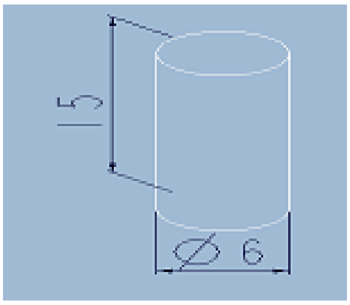

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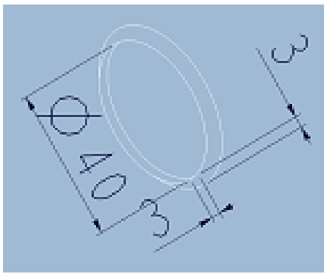

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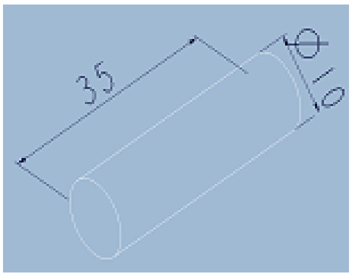

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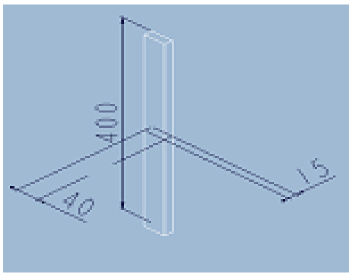

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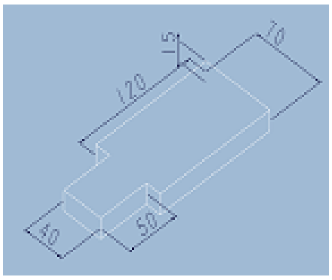

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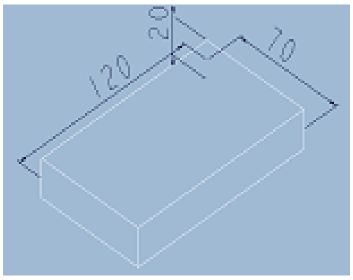

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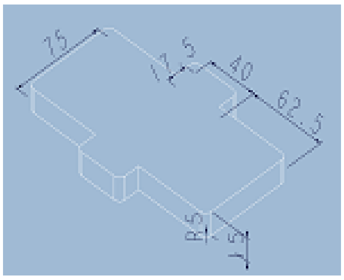

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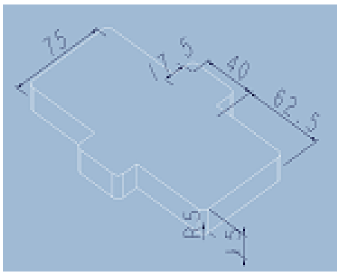

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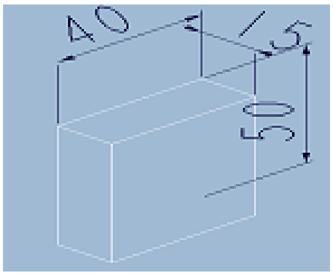

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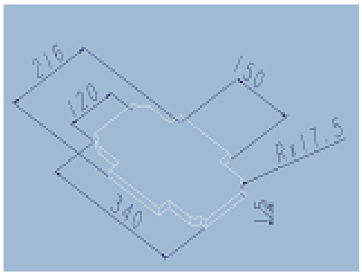

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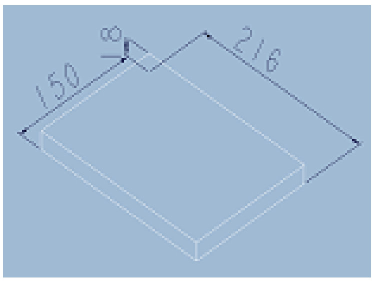

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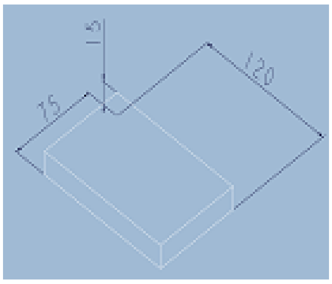

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Figure 7: Each Feature (26#) Individual Dimensions for Writing Algorithms

CONSTRUCTION OF FEATURE NETWORK

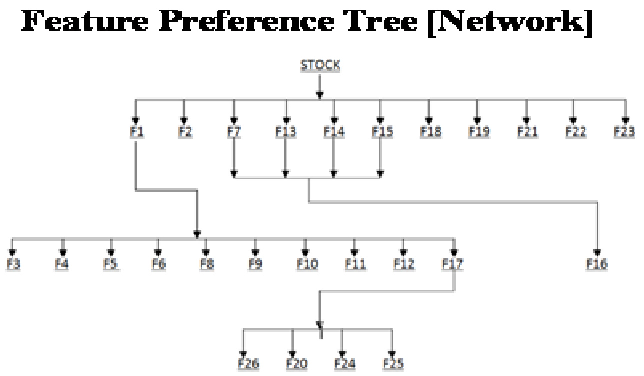
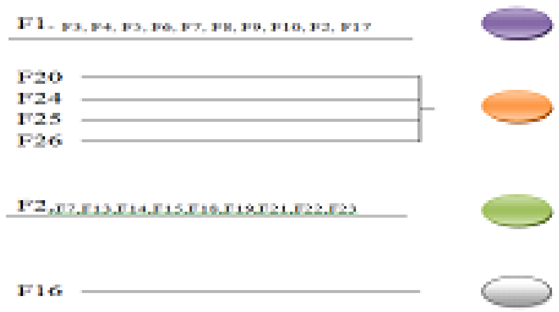


Figure 8: Feature Network for Sequential Machining Operation

Color Coding for Identifying the Group Families



Color Images for Part Identity

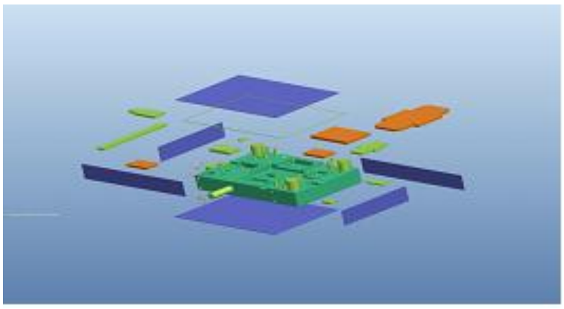
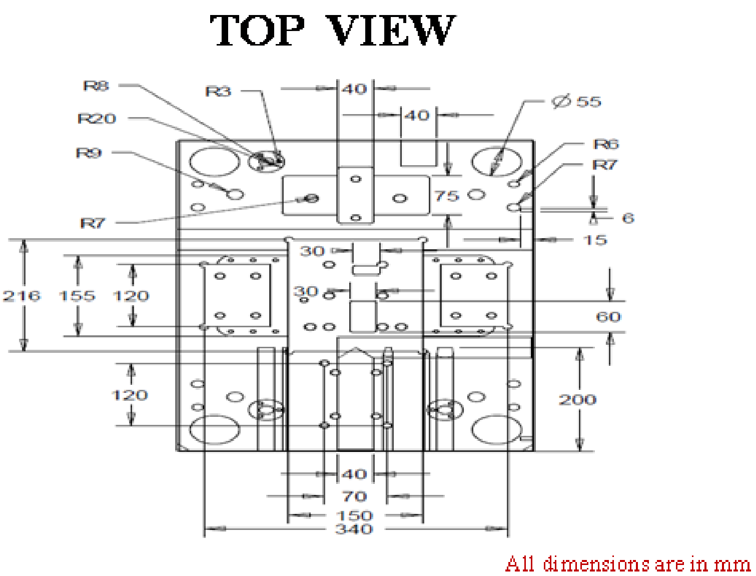


Figure 9: Extraction of Feature with Color Coding



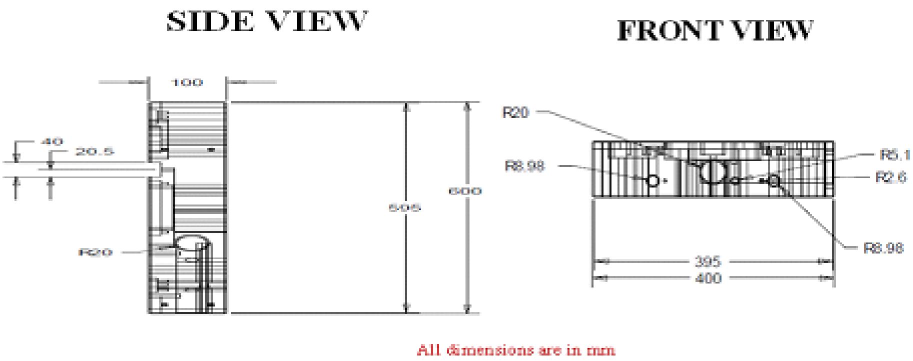


Figure 10: 2 Dimensional Drawing of Model Prismatic Part

CONCLUSIONS

- This paper deals with a procedure for the machining feature extraction of prismatic component.
- The main focus is to identify machined areas from a final part model. In the case of prismatic components, to avoid the rough part model the near net shaped stock has been considered.
- To develop an efficient algorithm, the each machining feature has been introduced with group families along with desired dimension.
- The coordinate system can be implemented to achieve exact tool path of the cutter to finish the required machining operation.
- The color coding system for each group of machining feature has been given to identify the sequence of process planning.
- This paper makes use of basic approach to start CAPP system for prismatic parts.
- This paper proposes an efficient algorithm identifying machined areas. The algorithm is based on a 2.5D.

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