

DESIGNING A WOODEN ROOF

Naida Kulenović, Davor Midžić, Minka Ćehić
University in Bihać, Faculty of Technical Engineering, I.Ljubijankića bb, tfb@bih.net.ba

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ABSTRACT:

Modern manufacturing process of wooden structures characterized by the use of computers in the design phase and the preparation of the production process and the use of automatic machines and lines for the production of timber structures. The paper presents the modern mode of production of timber structures with emphasis on the production of roof structures. Design and preparation of manufacturing wooden roof was made by using Software Dietrich's DHP 12_98.

The aim of this paper is to present both a modern way of designing two-stressful roof with the use of computers.

1. INTRODUCTION

Of new technologies, software development has had the most interest in the development of all functions of the production system, including the new production philosophy. New production philosophy, CIM (Computer Integrated Manufacturing - computer integrated manufacturing), was proposed in the period from 1983 -1988. whatever. According to many authors, such as Merchant, Alting, Allen, Bollinger, Spur, Yoshikawa, integrated production systems should form the main part of the factory for the 21st - in the century. Thanks to the rapid development of computer science, CAE (*Computer Aided Engineering*) found great application in design and manufacturing, that is in CAD (*Computer Aided Design*) and CAM (*Computer Aided Manufacturing*).

Developed various computer software packages that enable the rapid design drawings of the total roof structure and individual roof elements. Total production process roof is completely driven by the computer and is based on the basic recommendations of the various standards and basic design solutions.

2. SOFTWARE FOR DESIGNING WOODEN ROOF

The timber industry there is two types of software that are used CAD and CAM systems:

- CAD (Computer - Aided Design) - which when translated means "Computer Assisted Design". Advantages are: the productivity of the designer, the quality of the final product and the improvement in the work, 2D vector drawings, 3D modeling and design elements. Most CAD systems are: AutoCAD, SolidWorks, Autodesk Inventor, SolidEdge, Pro / ENGINEER, Parasolid, ACIS, ArhiCAD, Dietrich's DHP etc.
- CAM (Computer - Aided Manufacturing) - which when translated means "mechanical production with the help of computers." CAM is the use of computer software in the control and management of machines for the production of work pieces. CAM systems are used in conjunction with CAD systems, as a product that is designed in the CAD system can be directly

produced in a plant which is operated using a CAM system. The best-known companies in the development of CAM systems are: Dassault Systems, Siemens PLM, Delcam, Vero Software, PTC, Tebis, Cimatron etc.

3. EXAMPLE DESIGN DOUBLE-PITCH ROOF

Working with Dietrich's DHP will be explained through an example of designing one roof. Projected to be a double-pitch roof using roof truss as the basic structural elements. The initial dialog box Dietrich's DHP 12_98 basic program for making some wooden structures in general, and thus the roof, is shown in Picture 1.

The Picture shows that the left side of the box is going into certain parts of the program, ie to define a new project or revision (work) in an existing project, the part of the list of materials - materials, drawings, equipment as well as the entrance to the subprogram for defining the new files to the frame structure.

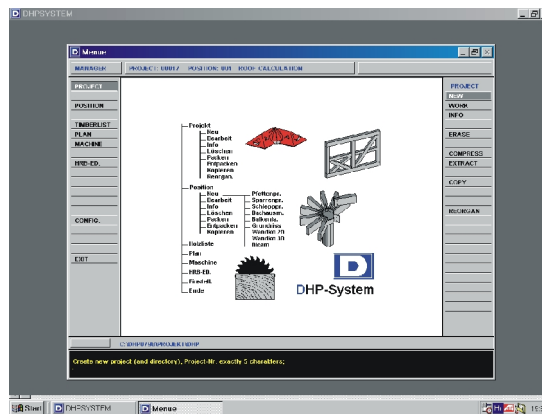


Figure 1. The initial dialog box Dietrich's DHP - this basic program design of roof structures

Clicking on the desired type of work, eg roof following dialog box is selected mode for defining the layout of the building - a graphical or tabular form or method, however, can choose among a number of ground plan object. The general data input on the ground plan of the roof is defined: wall dimensions, their relative positions by mutual internal or external corners which closes adjoining walls, slope roof surface, the width of the eaves height of the 0 - and the elevation point to the starting point of the roof, and possible changes in one flat roof surfaces, ie whether certain roof areas one "plate" appropriate form, or it consists of multiple "panels" particular form set out in a specific altitude interval.

Selecting the option to work on the roof space comes in part program in which selected elements of the roof that will contain the data. Disposal eight functional options: data entry for creating elements balcony railings, processing projecting eaves, beams in the ceiling (ceiling), hip / valley, purlins, rafters, ties and sheeting roof surfaces.

After entering all necessary data on hip/ valley roof, clicking the right button in the framework come out from this part of the program and there is a dialog box that provides the ability to work on defining the other components of the roof. Selection of options such as data entry related to the rafter come to the next dialog box that allows you to select an option to enter data for each roof plane or for the entire roof, and to define ways of connecting two rafters on opposite roof surfaces and forms

rafters. The other two options are offered to control: a perspective view roof and display the cross section.

If you choose the option to enter the data for the entire roof follows a dialog box in which responding to queries about the same mandatory internal space, the dimensions of the rafters (width and height), the spaced between adjacent rafters, on the distance between the starting point of the roof surface and the first / last rafter on that particular roof surface, the connection of rafters with the lower purlins, the user defines the roof rafters. Confirm that all information is accurate, the program propose and show schedule rafters to given criteria.

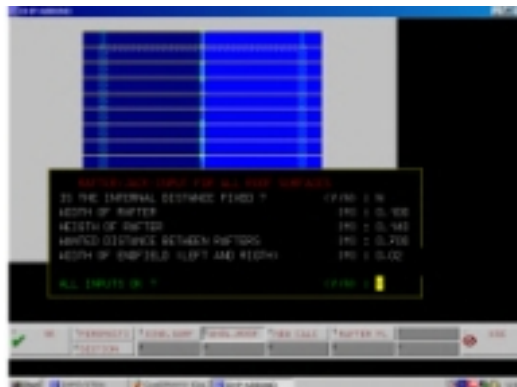


Figure 2. The dialog box for defining rafters

The next step in the design of the roof - an example would be the definition of data related to purlins and roof truss. User disposal the ability to work on a one roof surface or the entire roof, as well as any adjustments set purlins. Input data for the entire roof purlins show in the table and the program propose minimum necessary purlins, leaving the user the possibility of correction or input new purlins with the obligation of the user to define the dimensions of the purlins (width and thickness).

After defining all necessary purlins can be accessed by defining the elements of roof truss. By selecting the "post" is coming to the dialog box in which it is possible to define precisely defined purlins (sole plate, center purlin or ridge purlin) below which will stand post. The user has the options available for data entry on the post, brace, and roof tie and for the correction of designing elements.

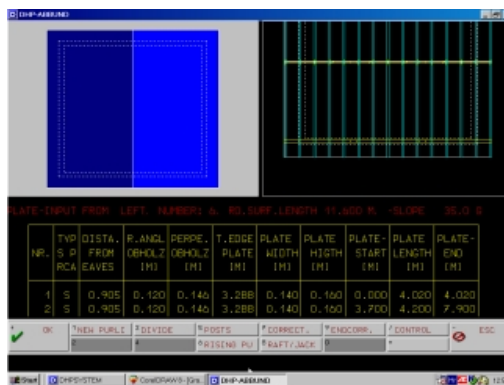


Figure 3. The dialog box for defining purlins on the roof surface

Upon completion of data entry for the posts under a certain purlins, can be accessed by entering the data about brace. Responding to queries on the type of brace (left, right or double), the thickness and width of the brace, the length brace defined by point on Y-axis, who brace corner close to the post, the connection (eg joint), the length of the joint, user define brace.

When you define all the elements of the roof software required entering data on the quality and level of processing materials, the choice of whether you need to sort the elements of the roof for possible processing at particular CAM equipment. As a result of the design the roof, software offers making lists of materials, all the technical drawings (working drawing and assembly drawing), and the possibility that the projected roof via a floppy disk or removable media like computer directly transferred to the CAM equipment to produce a roof.

no.	pos.	variant	description	T.G.	width [mm]	height [mm]	Length [m]	title
1	1	1	1)RAFTER	B	50,0	14,0	7,131	ROGO
2	2	1	2)RAFTER	B	50,0	14,0	7,131	
3	3	1	1)POST(STUD)	B	50,0	10,0	3,306	STUP
4	4	1	1)POST(STUD)	B	50,0	10,0	3,306	
5	5	1	1)POST(STUD)	B	50,0	10,0	3,306	
6	6	4	1)BRACE	B	50,0	10,0	1,471	BRZE
7	7	1	1)SOLE PLATE	B	14,0	10,0	4,000	NAZDENICA (DONIA1)
8	8	1	1)SOLE PLATE	B	14,0	10,0	4,000	
9	9	1	1)SOLE PLATE	B	14,0	10,0	4,000	
10	10	1	1)EDGE PURL.	B	14,0	10,0	4,000	SLJEMENA GREDA
11	11	1	1)EDGE PURL.	B	14,0	10,0	4,000	
12	12	1	1)EDGE PURL.	B	14,0	10,0	4,000	
13	13	1	2)SOLE PLATE	B	14,0	10,0	4,000	NAZDENICA (DONIA2)
14	14	1	2)SOLE PLATE	B	14,0	10,0	4,000	
15	15	1	2)SOLE PLATE	B	14,0	10,0	4,000	

Figure 4. List of materials



Figure5. Working drawing one rafter

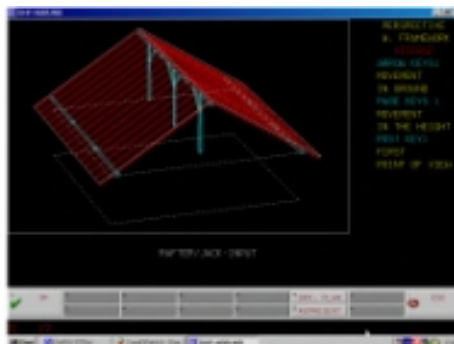


Figure 6. Perspective view of the roof

The pictures are some of the output projected double-pitch roof.

6. CONCLUSION

In our example we used Dietrich's DHP is combined CAD / CAM system. Through working with Dietrich's DHP software we best understand the advantages of using software solutions to conventional printing methods. In our example, the roof design using Dietrich's DHP software design of the roof was done in less than 2 hours and immediately we get a chance to list of materials needed for our roof ready for processing at the plant, which is operated CAM system. The mere preparation

of material to work using conventional methods and equipment would last for several days, and the application of mechanized plants with CAM systems, materials processing takes only a few hours. From this we conclude that the greatest advantage of computer systems in efficiency, time savings, enabling the designer to immediately see the finished project in 3D and on the eve of possible errors and make corrections thereof. From the economic point of view the production of the necessary wooden structures have optimized consumption wooden materials and precise processing elements for using CAM system and normally drastic time savings in the design and manufacture of wooden structures and relative energy savings compared to the conventional way of designing and making the roof. We can conclude that the introduction of computer software solutions in the design and manufacture of wood roof structures led to big time savings and of course, energy savings and reduction of waste materials, and because the business world leads the dictum "time is money" that we have a big financial savings.

7. LITERATURE

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