

APM Cam

User's Guide

APM Cam

The system for cam calculation and design

Version 9.0

User's Guide

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Introduction

APM Cam-what is it?

APM Cam is the system for cam mechanism calculation and design developed in the Research and Software Development Center **APM Ltd.**

Using **APM Cam** user can calculate the following characteristics of cam mechanisms:

- cam profile
- coordinates of the internal and external envelopings of central profile (for cam with rollers)
- angle of pressure

The system allows designing of four types of cams mechanisms:

- cam mechanism with roller arm
- cam mechanism with flat arm
- cam mechanism with roller rocker
- cam mechanism with flat rocker

With **APM Cam** you can generate the working drawings of the cam profile in APM Graph and DXF formats.

Hardware and software requirements

APM Cam runs on the IBM PC family of computers (including all true IBM compatibles). **Cam** itself does not require a math coprocessor. **APM Cam** is intended to run under Microsoft Windows 2000, XP.

What's in this manual

Introduction (this section) tells you what **APM Cam** is in general, what types of cam mechanisms could be calculated. The requirements to hardware and system software are listed.

Chapter 1, Tasks and results contains description of the tasks you can do with **APM Cam**. All the calculated parameters and initial data are listed.

Chapter 2, How to work with APM Cam leads you through a sample session in order to demonstrate main operations -- how to install and start the program, enter initial data, perform calculations, browse the results, specify working drawing.

Chapter 3, APM Cam in questions and answers contains answers to common questions that may arise when you work with **APM Cam**.

In **Chapter 4, Initialization file CAM.INI**, format of a configuration file CAM.INI is described.

Chapter 5, Elements of the user interface APM Cam describes elements of the program **APM Cam**.

Chapter 6, Commands reference contains complete description of all the commands implemented in the system.

Typefaces used in this book

To facilitate reading and avoid misunderstanding we use a set of typefaces. Their uses are as follows.

<code>a:\setup</code>	This typeface represents text as it appears or anything you must type (for example, <code>a:\setup</code> to start installation program).
<code>SETUP.EXE</code>	We use all capital letters for the names of files and keys.
Help	APM Cam command names are shown in boldface.
<i>Results</i>	Italics is used for the names of dialog boxes and controls

How to contact APM

To contact **APM** you can use one of the following ways:

Send fax. Our Moscow fax number is +7(495) 585-06-11.

Send e-mail: com@apmwm.com

Call by phone +7(495) 585-06-11, 514-84-19 (Moscow).

Write a letter and send it to:

Research and Software Development Center APM LTD
Korolev-Center, box 58
Moscow Region
141070 Russia

<http://www.apmwm.com>

Chapter 1 Task and results

The system **APM Cam** is intended for cam mechanism engineering. Cam mechanism is the elementary mechanism that is used to transform movement and to manage device element movement according to given program. With **APM Cam** you can do the following:

- specify a type of cam mechanism and enter all necessary data
- calculate cam parameters
- generate working drawing of the cam

The types of cam mechanism

The system allows to calculate and design the following types of cam mechanisms:

- cam mechanisms with roller arm
- cam mechanisms with flat arm
- cam mechanisms with roller rocker
- cam mechanisms with flat rocker

Initial data

To calculate cam mechanism the following initial data are required:

Cam mechanism with roller arm:

1. Eccentricity
2. Roller radius
3. Guide length
4. The distance between guide and cam rotation center
5. Cam thickness
6. Critical angle of pressure
7. Minimum cam radius
8. Resultant resistance force
9. Allowable pressure
10. Young's modulus of a cam
11. Young's modulus of a tip
12. Cam-tip friction coefficient
13. Friction coefficient in the guide
14. Safety factor for angle of pressure

The mechanism with flat arm:

1. Guide length
2. The distance between guide and cam rotation center
3. Cam thickness
4. Minimum cam radius
5. Resultant resistance force
6. Allowable pressure

7. Young's modulus of a cam
8. Young's modulus of a tip
9. Cam-tip friction coefficient
10. Friction coefficient in the guide

The mechanism with roller rocker:

1. Roller radius
2. Guide length
3. The distance between guide and cam rotation center
4. Cam thickness
5. Critical angle of pressure
6. Minimum cam radius
7. Resultant resistance force
8. Allowable pressure
9. Young's modulus of a cam
10. Young's modulus of a tip
11. Cam-tip friction coefficient
12. Safety factor for angle of pressure

The mechanism with flat rocker:

1. The distance between rocker base and cam rotation center
2. Cam thickness
3. Minimum cam radius
4. Resultant resistance moment
5. Allowable pressure
6. Young's modulus of a cam
7. Young's modulus of a tip
8. Cam-tip friction coefficient

Results

APM Cam allows to calculate the following parameters:

Cam mechanisms with roller arm and rocker:

- Cam profile
- Polar and Cartesian coordinates of central profile, external and internal envelopings around central profile
- The diagram and the table of angle of pressure.

Cam mechanisms with flat arm and rocker:

- Cam profile
- Polar and Cartesian coordinates of cam profile

Working drawing

The important feature of system is the opportunity of cam working drawing generation in APM Graph and DXF formats. The user can call **APM Graph** directly from the program to finish the drawing and get the hard copy.

To specify the drawing intuitively clear graphics interface is used; it allows to get the working drawing of the cam with minimum efforts.

To generate cam drawing the following parameters should be entered:

Cam construction

1. Cam hub type
2. Type of cam-shaft joint
3. Spline parameters
4. Dimensions:
 - Inner hub diameter
 - Outer hub diameter
 - Hub length

Specifications

1. Fillet radii that are not specified on the drawing
2. Dimension deviations that are not specified on the drawing:
 - In the shaft system
 - In the opening system
 - Other dimensions

Title block contents*

1. The person developed the drawing.
2. The person who has checked up the drawing
3. The person responsible for checking of standards
4. The person responsible for technical control
5. The person approving the drawing.
6. Designation of the drawing.
7. Material mark.
8. Material standard.
9. Letter of the drawing.
10. Organization that has developed the drawing.
11. Subdivision of the organization that has developed the drawing.

* The program does not check these parameters, so the user is responsible for their correctness.

Chapter 2 How to work with APM Cam

APM Cam provides the user with convenient and intuitively clear interface based the standards CUA (Common User Access) and GUI (Graphical User Interface). The typical sequence of actions includes the following operations:

1. Start the program
2. Select cam mechanism type
3. Enter initial data
4. Perform calculations
5. Review the results
6. Enter drawing data
7. Call AutoCAD to finish the drawing and get hardcopy

Start the program

To start **Cam** open APM WinMachine file group (it is created during system installation) and choose in it the **APM Cam** icon.

Select cam mechanism type

To select cam mechanism type use **Data | Type** command, press Ctrl-T or double click the left button of the mouse in the *Cam Type* window. In the dialog box that appears on the screen choose the type of the cam mechanism you want to calculate.

Enter initial data

To enter initial data use **Data | Geometrical data** (Ctrl-G) and **Data | Physical data** (Ctrl-I) commands. In reply to these command the dialog boxes for initial data input will be displayed. The contents of these dialog boxes depend on the type of cam mechanism.

All the initial data are divided into two groups: - the general data, which absence makes the calculations impossible, and the "restrictions". The dialog boxes that are displayed contain the controls for general data input and "More..." button. If you will select this button, the dialog box will be called where you can enter the restrictions.

The system performs checking of entered values. If any of them falls outside the allowable limits, the system displays warning message (see fig. 2.1).

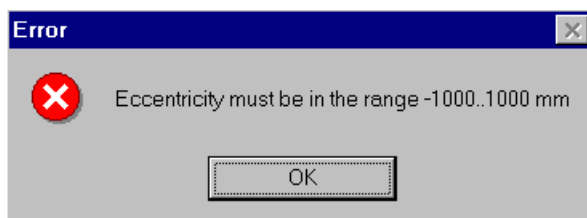


Fig. 2.1 Warning message that is displayed in the case of entering wrong initial data

The input of driven link movement law

To enter the driven link movement law select **Data | Function** command (Ctrl-F).

Archive file loading

If you want to calculate earlier designed cam mechanism that was saved to archive file with **File | Save** command, use advantage of **File | Load** command. After loading the archive file, you automatically restore the state corresponding to the moment the file was created.

Calculations

After all the initial data are entered, you can carry out the calculations by choosing a **Calculations** command.

If the system cannot calculate cam with the parameters entered, it shows the error message (see fig. 2.2). The list of error messages is given in the appendix 1. Correct wrong data and repeat calculations.

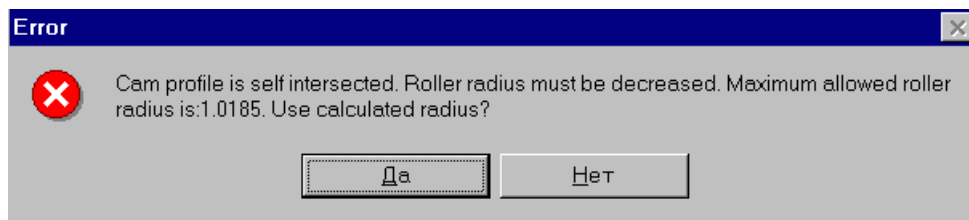


Fig. 2.2 Error message example

Results browsing

After the calculations are finished, you can browse the results by selecting **Results** command. It invokes the dialog box, containing the buttons each demonstrates specific group of results.

Archive file saving

To save initial data and calculation results use **File | Save** command. It invokes standard dialog box where you can specify archive file name.

Printing

To print out the results use **File | Print** command. It displays the dialog box where you can select the items to be printed. To confirm selection use "Print" button. The standard Windows *Print* dialog box will be invoked, where you can specify printing options. After that the window is displayed that shows printing progress (see a fig. 2.3). At any moment you can stop printing, by pressing the button *Cancel*.

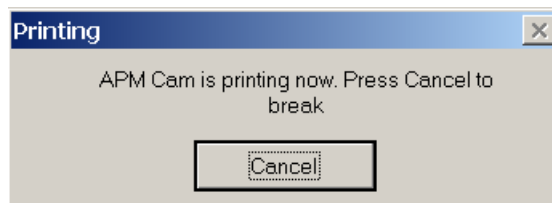


Fig. 2.3 Printing progress window.

Working drawing generation

APM Cam allows user to create working drawing of the cam. To generate the drawing you should do the following:

- Select **Drawing** command
- In the window titled *Drawing* enter parameters that specify cam construction and drawing contents (see fig. 2.10)
- Press **Save As** button.
- If necessary, perform final editing of the drawing in the loaded graph system and get hard copy on the printer or plotter.

Input of parameters describing the drawing

The main window of the drawing generation subsystem of the drawings includes a number of zones, each responsible for specific group of drawing parameters (see fig. 2.4).

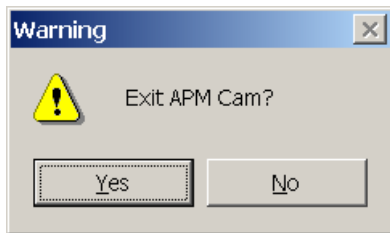


Fig. 2.4 The main window of drawing generation subsystem

- Zone 1 - Title block of the drawing.
- Zone 2 - Cam construction.
- Zone 3 - Angular step in the table of cam profile coordinates.
- Zone 4 - Specifications.

Cam construction entering

To specify cam construction use *Zone 2* (see above). To activate this zone double click on it. This action initiates the sequence of dialog boxes each responsible for specific feature of cam construction. Each of these dialog boxes includes *Next* button that confirms entered data and invokes the next dialog. The variants of construction are presented in the form of bitmapped buttons facilitating the selection.

The dialog boxes for cam construction include:

- The *Cam Hub* dialog box
- The *Cam-Shaft Joint* dialog box
- The *Spine Joint* dialog box (this dialog box is displayed if in the previous step you select spline joint)
- The *Dimensions* dialog box
- After you enter all the data, **Save As** button becomes available to generate cam drawing.

Title block

To fill the title block select *Zone 1*. The dialog box will be displayed that allows you to enter respective data. To access the fields that are currently invisible use scroll bars.

Angular step entering

To enter the angular step of cam profile coordinates select *zone 3*.

Specification input

To enter the specifications you should activate *zone 4*. The dialog box is displayed where you can enter corresponding parameters (see chapter 1 for the list of specifications).

Drawing generation

To generate a drawing select **Save As** button, that becomes available after you specify cam construction in the *Zone 2*. This command invokes standard *File Save* dialog box. By selecting *Ok* button in this dialog box you start drawing generation.

Getting drawing hardcopy

To get drawing hardcopy use corresponding command of the CAD system you have loaded by Save As command. See CAD system manual for details.

Exit the system

To exit **APM Cam** use **File | Exit** command.

Chapter 3 APM Cam in questions and answers

Question: What is APM Cam?

Answer: The program **APM Cam** is intended for cam mechanism calculation and design. The program is developed in the *APM Research and Software Development Center APM, Moscow, Russia*.

Q: What types of cam mechanisms can be calculated using APM Cam?

A: The system **APM Cam** allows to calculate the following cam mechanisms:

- cam mechanism with roller arm
- cam mechanism with flat arm
- cam mechanism with roller rocker
- cam mechanism with flat rocker

See section *Types of cam mechanisms* in Chapter 1 for details.

Q: What parameters of cam mechanisms can be calculated with APM Cam?

A: With **APM Cam** the following parameters can be calculated:

- Cam profile
 - coordinates of the internal and external envelopings of central profile (for cam with rollers)
 - Angle of pressure
- See section *Results* in Chapter 1 for details.

Q: How to save initial data and results?

A: Use **F**ile | **S**ave command or press CTRL + S. In the *Save Archive File* dialog box enter file name and select *Ok* button. See section *Save Data command* in Chapter 6.

Q: How to load data and results from archive files?

A: Select **F**ile | **L**oad command or press CTRL + L. Use *Load Archive File* dialog box to point out archive file you want to load. See section *Load Data command* in Chapter 6.

Q: How to get help?

A: Use **H**elp | **C**ontents command or press F1. Use mouse or TAB key to select topic of interest. Topic text will be displayed. All dialog boxes implemented in the **APM Cam** have *Help* button. Select it to get help on the dialog box displayed. Help window has menu in its upper part. Use **H**elp | **H**ow to Use **H**elp command of this menu to get information on basic principles of using help function in Microsoft Windows.

Q: How to contact APM?

A: Our phone/fax in Moscow: +7(495) 585-06-11, 514-84-19.

Our address:

Research and Software Development Center APM LTD
Korolev-Center, box 58
Moscow Region
141070 Russia
e-mail: com@apm.ru
<http://www.apm.ru>

Chapter 4 System initialization file CAM.INI

The file of system initialization CAM.INI is used by program to store the current values of system settings and system variables. This file is created by program installation program in the WINDOWS directory (the directory that contains WIN.COM file). Below we give the typical contents of this file:

[Call]

```
ACAD = YES
ACAD.EXE = acad.exe
PROTOTYPE = acadapm
IMPORT = dxfin
ZOOM = zoom
ZOOM2 = a
```

[Draw]

```
DESIGN = Ushakov M. A.
CHECK = Zhukov N.I.
NCONTROL = Klypin A. V.
TCONTROL = Shelofast V.V.
CONFIRM = Shelofast V.V.
LABEL = 08766/8766
MATERIAL = 40X13
STANDARD = 1475-78
LITER = 000
FIRM = APM center
DEPARTMENT = Design
RADIUS = 3.00
SHAFTACC = h11
OPENINGACC = H11
ANOTHERACC = IT11/2
LENGTH = 30.000
DISPLACEMENT = 5.000
DIAMETER = 10.000
DIAMETERACCKVPL = H 7
DIAMETEREXT = 20
STYPE = 2
COMBINATION = 1
SERIES = 2
CTYPE = 2
```

From the listing above it can be seen that file consists of the several entitled sections. The heading of the section begins with opening bracket "[" and ends by closing bracket "]". Each section contains the information on the group of interrelated topics. For example, section **[call]** stores the information concerning CAD system that can be loaded from the program, **[path]** - the paths to files required by Cam system, **[draw]** section - parameters of drawing.

Let's consider in more detail the contents of each section:

- **[call]** section

The statements describing the script file of the AutoCAD system.

4. IMPORT - the name of command that import DXF files. The statement is used to facilitate use of localized versions of AutoCAD.

5. ZOOM - the name of command that performs drawing zooming.

6. ZOOM2 - the name of command that performs zooming that provides displaying of all elements of the drawing.

- **[path]** section

ACAD - complete path to main executable module of the CAD system to be loaded by **Cam** system.

- **[draw]** section

1. DESIGN - the person developed the drawing.

2. CHECK - the person who has checked up the drawing.

3. NCONTROL - the person responsible for checking of standards.

4. TCONTROL - the person responsible for technical control.

5. CONFIRM - the person approving the drawing.

6. LABEL - designation of the drawing.

7. MATERIAL - material name.

8 STANDARD - material standard.

9. LITER - letter of the drawing.

10. FIRM - organization that has developed the drawing.

11. DEPARTMENT - subdivision of the organization that has developed the drawing.

12. RADIUS - size of the not designated radiuses.

13. SHAFTACC - accuracy of the sizes in the shaft system.

14. OPENINGACC - accuracy of the sizes in the opening system.

15. ANOTHERACC - accuracy of other sizes.

16. LENGTH -hub length. A real number.

17. DISPLACEMENT - displacement of hub face relative to end cam face. A real number.

18. DIAMETER - diameter of hub opening. A real number.

19. DIAMETERACCKVPL - tolerance and accuracy of the hub opening. A real number.

20. DIAMETEREXT - hub diameter. A real number.

21. STYPE - hub type. An integer in the range 0 - 2.

22. COMBINATION - the type cam-shaft joint. An integer in the range 0 -2.

23. SERIES - the series of spline joint. An integer in the range 0 - 2.

24. CTYPE - the way spline joint centering. An integer in the range 0 - 2.

Chapter 5 User interface

APM Cam is intended to run under Microsoft Windows 95 and later. So, those, who have any experience in Windows, will not encounter any problem with learning APM Cam. But if you haven't such experience, don't worry. User interface of APM Cam is fairly straightforward and intuitively clear. To learn how to perform calculations with APM Cam you will need no more than 1—2 sessions.

In this chapter we give you a brief description of the most frequently used APM Cam environment components.

Systematic description of all menu commands and dialog box options is given in Chapter 6.

Information windows

These windows are used to display a reference information. Three information windows implemented in the APM Cam are always on the screen. These are *Cam Type* window, *Initial Data* window and *Law of Movement*

Cam Type window

Cam Type window is located in the left upper part of the APM Cam screen (see Fig. 5.1). In this window the picture of the currently selected type of cam is displayed.

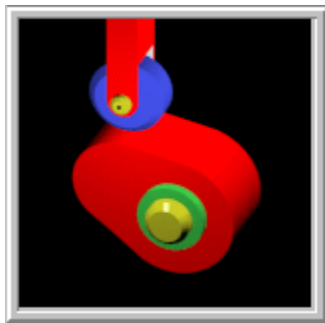


Fig. 5.1 *Cam Type window*

Initial Data window

This window is used to display initial data for cam to be calculated (see fig. 5.2). The contents of the window depend on the type of cam mechanism.

Eccentricity, mm	0	Result. Force, N	200
Roller Radius, mm	100	Allowable contact stress, MPa	1500
Guide Length, mm	20	Friction coeff. in contact	0.01
Distance to Center, mm	300	Friction coeff. in guides	0.01
Cam Thickness, mm	10	Safety factor for pressure angle	1

Fig. 5.2 Initial Data window.

Law of Movement window

In this window the law of driven link movement is displayed. The movement can be characterized by displacement, velocity and acceleration. In the left bottom corner the current dimension of coordinate Y is shown.

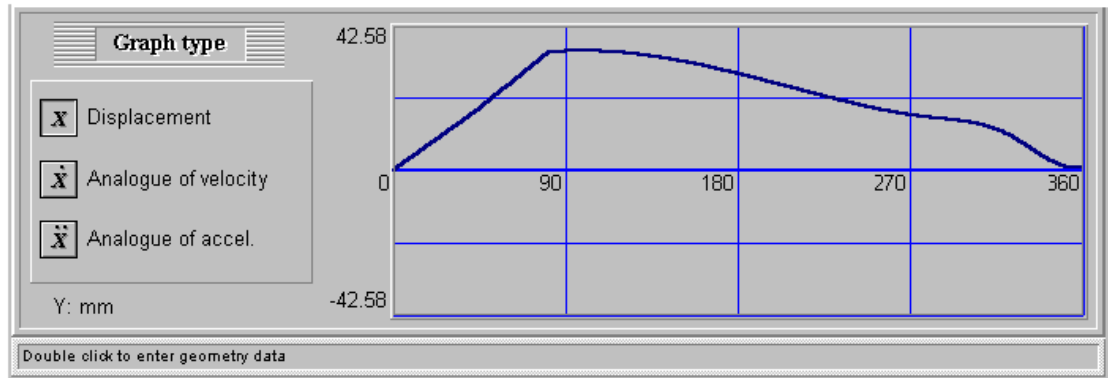


Fig. 5.3 Law of Movement window.

Status line

Status line is a small bar in the bottom part of the program window. It used to display various reference information (see fig. 5.4).



Fig. 5.4 Status line

Chapter 6 Command reference

In this section we give you a complete description of each menu command and dialog box option in the APM Cam environment. Fig. 6.1 shows the main menu of the APM Cam and all the pulldown menus called from the main menu.

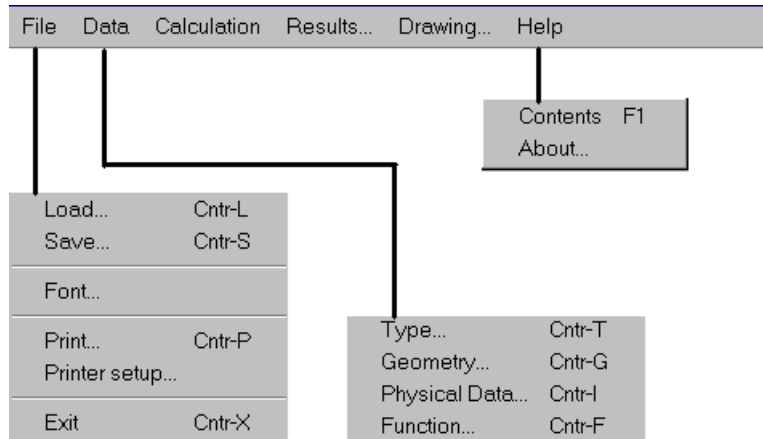


Fig. 6.1 APM Cam menu structure.

File menu

The **File** menu includes commands for

- loading information from archive files
- saving information to archive files
- printing initial data and calculation results
- choosing printer and printing options
- quitting the program




Fig. 6.2 The File menu

Load Command

Use **File | Load** command to load previously saved archive file.

Shortcuts

Toolbar 
Keys CTRL + L

Save Command

Use **File | Save** command to save initial data and calculation result to archive file.

Shortcuts

Toolbar 
Keys CTRL + S

Font Command

Use **File | Font** command to change the font used in the information windows.

Command Print

The **File | Print** command allows you to print out calculation results. When you select this command the dialog box shown in Fig. 6.3 is called on the screen. Some items of this dialog box can be inaccessible depending on type of cam mechanisms.

The *Angular Step* item determines the step of cam rotation used to fill the table with coordinate data.

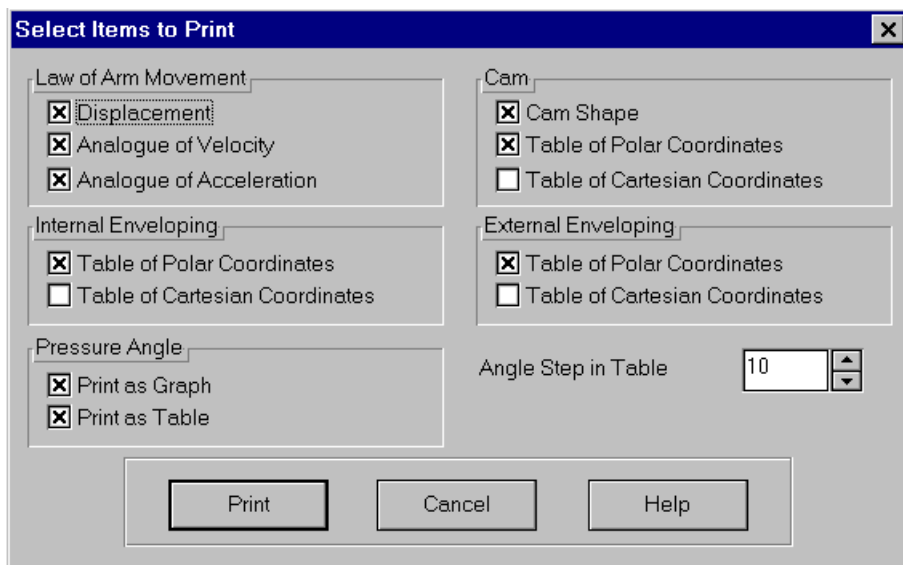


Fig. 6.3 The dialog box for selection of results items to be printed.

After you finish selection and press the *Print* button, the *Print* dialog box will be displayed (fig. 6.4). This dialog box is the standard for Microsoft Windows, see corresponding manuals for its description.

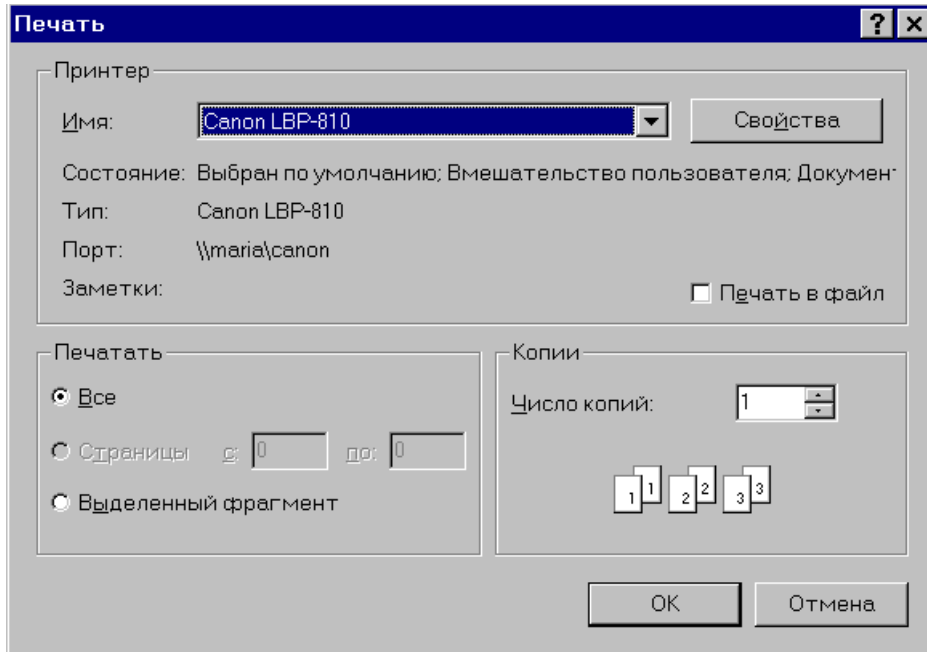


Fig. 6.4 The Print dialog box.

Shortcuts

Toolbar 
 Keys CTRL + P

Printer Setup Command

The **File | Printer setup** command invokes the Print Setup dialog box shown at Fig. 6.5.

With this dialog box you can specify printer settings. Using controls of *Printer* group box you can select type of printer (from a number of already installed in Microsoft Windows. To install new printer use *Printers* utility of *Control Panel* application, described in your Microsoft Windows User's Guide). With *Orientation* group box controls you can select how the printing will be oriented relatively to paper sheet—parallel to short side (*Portrait*) or to long side (*Landscape*). Controls of *Paper* group box let you choose paper sheet size (*Size* list box) and the type of paper advance (*Source* group box). And finally, *Options* button invokes printer-specific dialog box for more detailed tuning of printing.

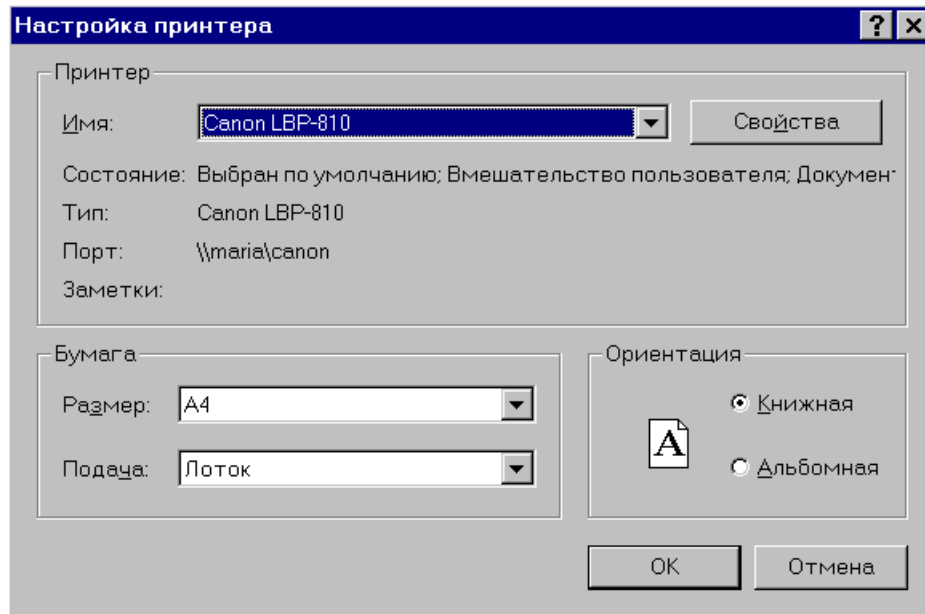


Fig. 6.5 The example of Print Setup dialog box

Exit command

Use **File | Exit** command to exit APM Cam.

Shortcuts

Keys CTRL + X

Data menu

The commands of Data popup menu allow user select cam type and enter initial data.

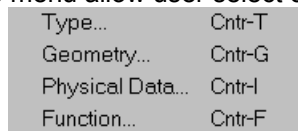


Fig. 6.6 The Data popup menu

Type command

The **Data | Type** command displays the dialog box for choosing the type of cam mechanism. This dialog box is shown in Fig. 6.7. The user should select the checkbox with the name of mechanism to be calculated.

Shortcuts

Toolbar 

Keys CTRL + T

Mouse Double click on the Cam Type window

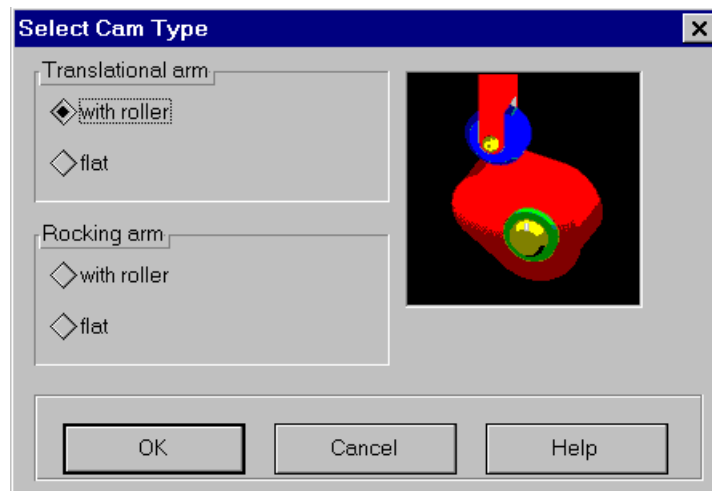


Fig. 6.7 The Cam Type dialog box

Geometrical Data command

This command displays on the screen the dialog box for geometry data input (fig. 6.8). The content of this dialog box depends on the type of the cam mechanism. For description of geometry data see chapter 1. To enter additional data use *More* button.

Shortcuts

Toolbar 

Keys CTRL + G

Mouse Double click on the Geometry Data window

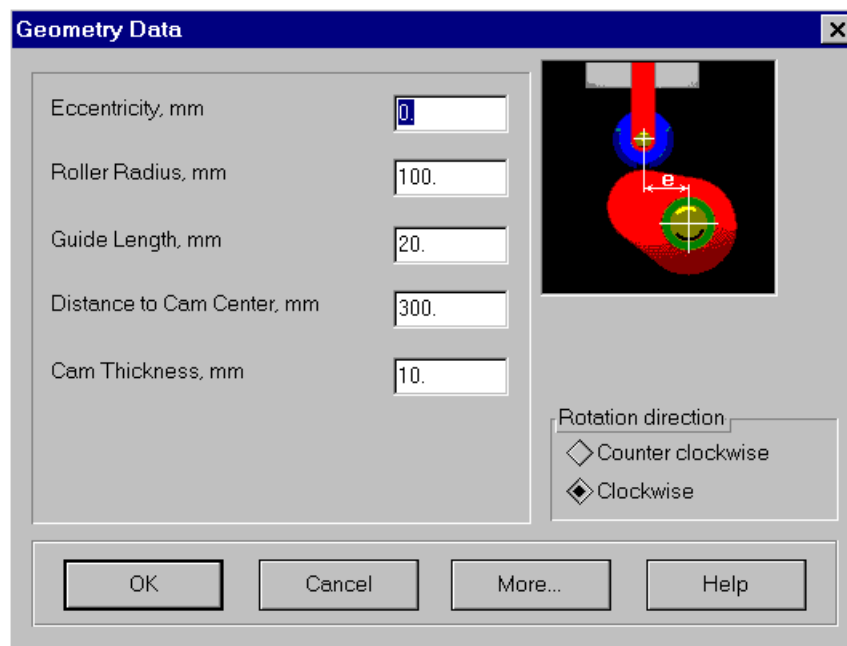



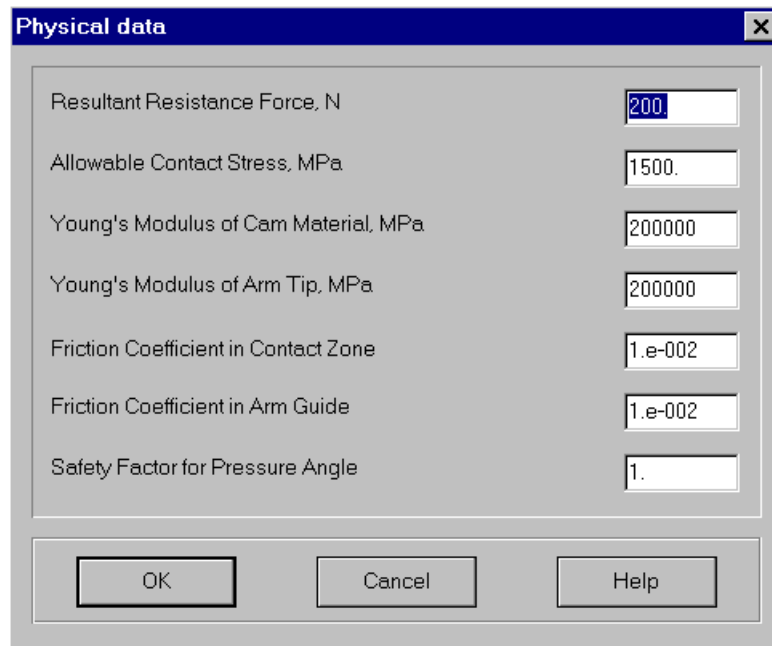
Fig. 6.8 The Geometry Data dialog box

Physical Data Command

This command displays on the screen the dialog box for physical data input (fig. 6.8). The content of this dialog box depends on the type of the cam mechanism. For description of physical data see chapter 1.

Shortcuts

Toolbar 
 Keys CTRL + I
 Mouse Double click on the Physical Data window



The image shows a dialog box titled "Physical data" with a close button (X) in the top right corner. It contains seven input fields with the following labels and values:

Parameter	Value
Resultant Resistance Force, N	200
Allowable Contact Stress, MPa	1500
Young's Modulus of Cam Material, MPa	200000
Young's Modulus of Arm Tip, MPa	200000
Friction Coefficient in Contact Zone	1.e-002
Friction Coefficient in Arm Guide	1.e-002
Safety Factor for Pressure Angle	1.


At the bottom of the dialog box are three buttons: "OK", "Cancel", and "Help".

Fig. 6.9 The Physical Data dialog box

Function Command

This command becomes available after user finish the geometry and physical data input. Use this command to enter the law of driven link movement.

Shortcuts


Toolbar 
 Keys CTRL + F
 Mouse Double click on the Law of Movement window

Calc Command

Use this command to start the calculations. During the calculations the window is displayed on the screen that shows the progress of calculations. To cancel the calculation select Cancel button or press the Space bar.

During calculation warning and error messages can be displayed.

Shortcuts

Toolbar 
 Keys CTRL + C

Results Command

The **Results** command invokes the Results dialog box (fig.6.10). For cam mechanisms with flat arm or rocker the buttons displaying the coordinates of internal and external envelopings are unavailable.

Shortcuts

Toolbar 
 Keys CTRL + R

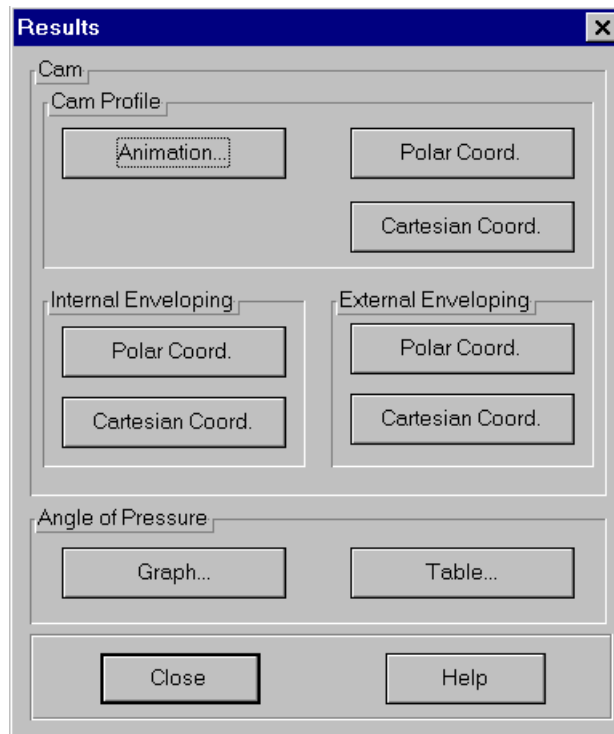


Fig. 6.10 The Results dialog box

Cam Profile Command

This button displays the window that allows to view the cam profile and the cam mechanism movement animation (fig. 6.11).

The elements of this window are as follows:



- zoom out | zoom in;



- start cam mechanism movement animation;



- returns the mechanism in its initial state (angle of cam rotation is equal to 0);



- reduce | increase the speed of cam rotation;



- the current speed of cam rotation in the conventional units.

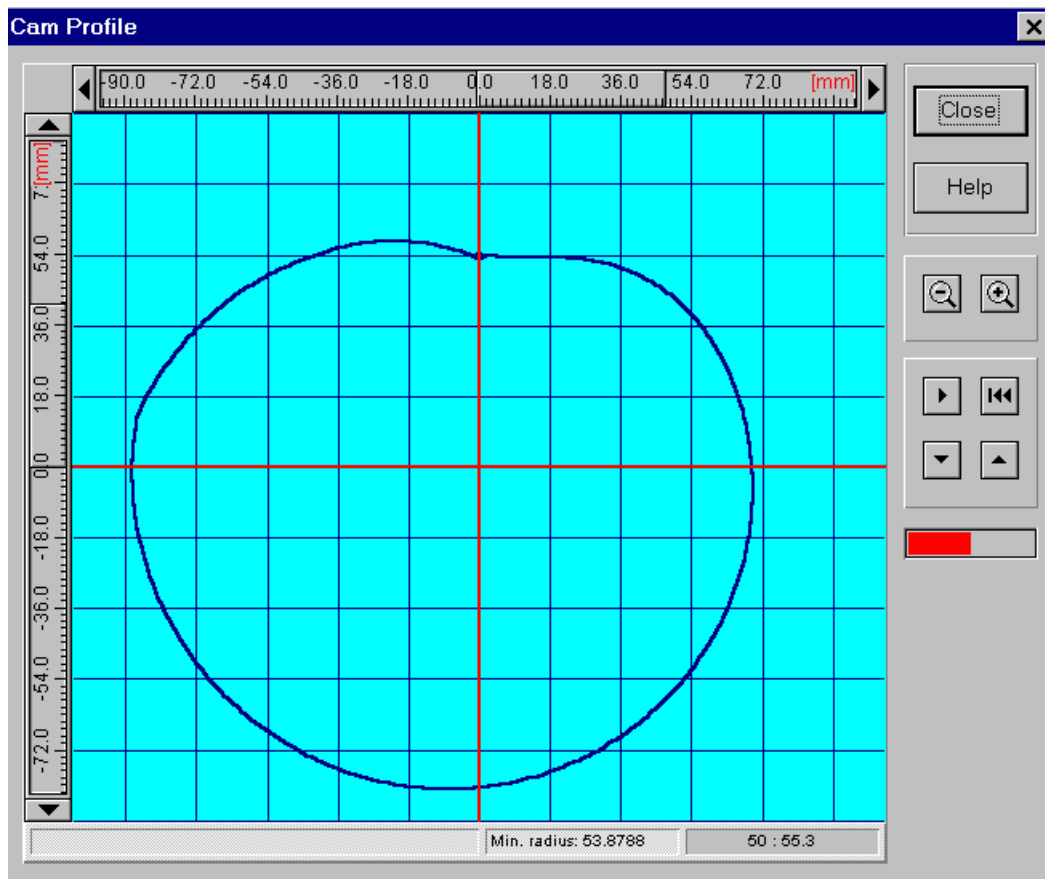


Fig. 6.11 The Cam Profile window

Acad menu

The main window of the drawing generation subsystem of the drawings includes a number of zones, each responsible for specific group of drawing parameters (see fig. 2.4).

- Zone 1 - Title block of the drawing.
- Zone 2 - Cam construction.
- Zone 3 - Angular step in the table of cam profile coordinates.
- Zone 4 - Specifications.

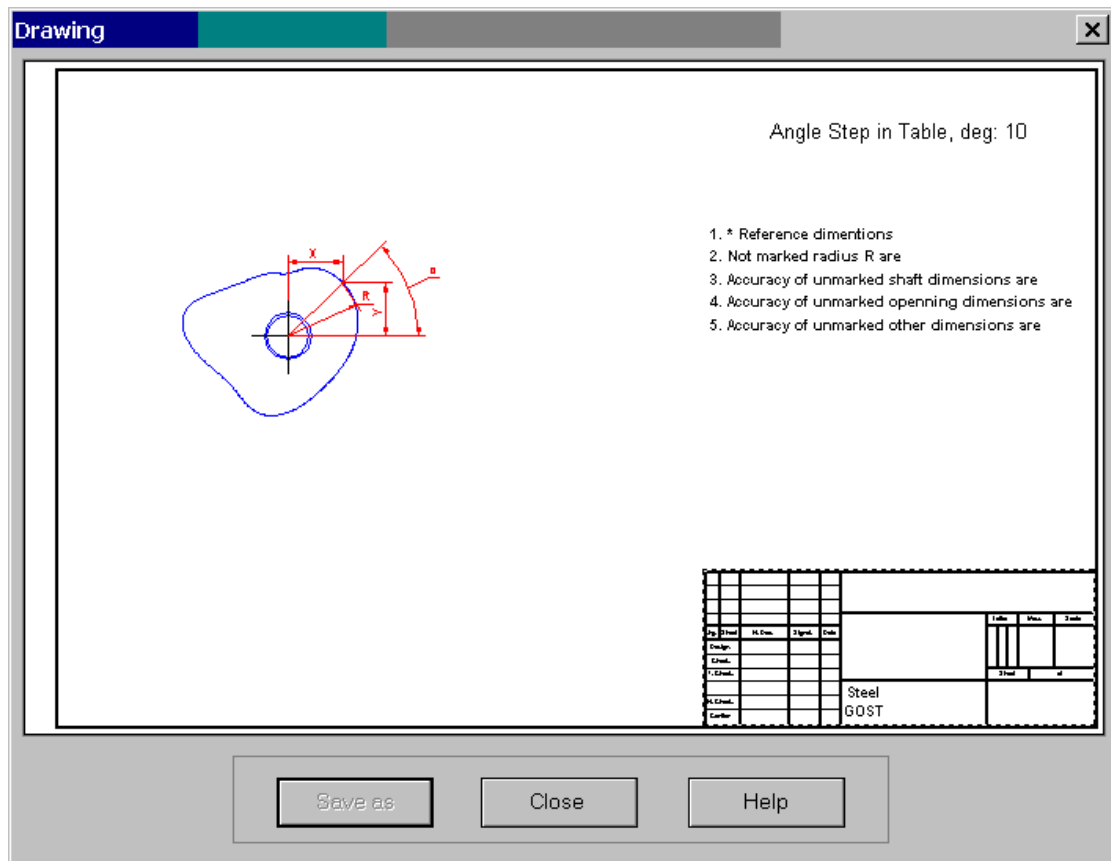


Fig. 6.12 The main window of drawing generation subsystem

Cam construction entering

To specify cam construction use *Zone 2* (see above). To activate this zone double click on it. This action initiates the sequence of dialog boxes each responsible for specific feature of cam construction. Each of these dialog boxes includes *Next* button that confirm entered data and invokes the next dialog. The variants of construction are presented in the form of bitmapped buttons facilitating the selection.

The dialog boxes for cam construction include:

- The *Cam Hub* dialog box (fig.6.13)
- The *Cam-Shaft Joint* dialog box (fig.6.14)
- The *Spine Joint* dialog box (this dialog box is displayed if in the previous step you select spline joint) (fig.6.15)
- The *Dimensions* dialog box (fig.6.16)

After you enter all the data, Acad button becomes available.

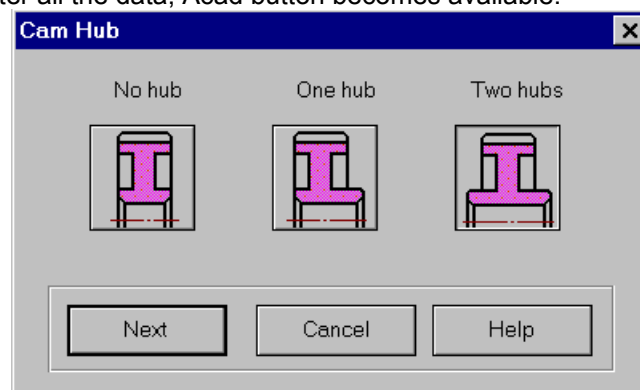


Fig. 6.13 The Cam Hub dialog box

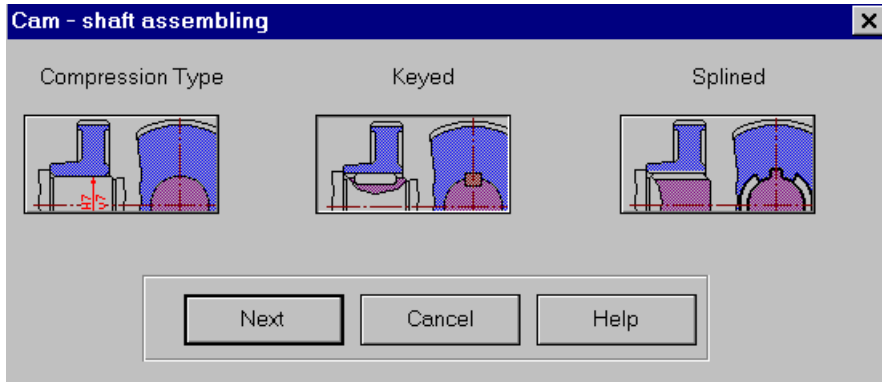


Fig. 6.14 The Cam-Shaft Joint dialog box

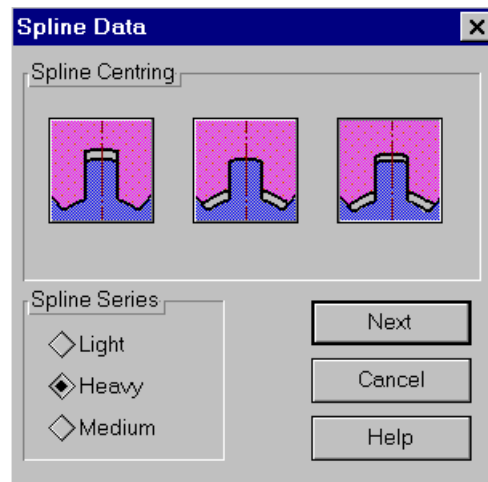


Fig 6.15 Spline Data dialog box

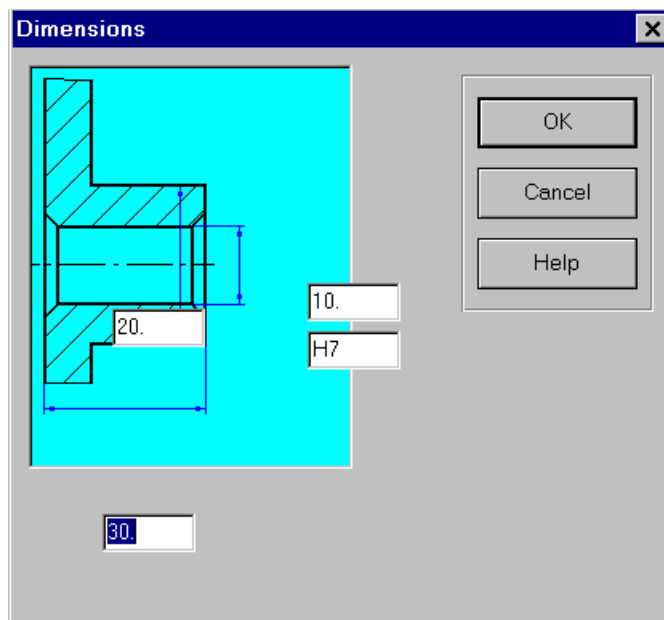


Fig. 6.16 Dialog Dimensions

Title block

To fill the title block select *Zone 1*. The dialog box will be displayed that allows you to enter respective data. To access the fields that are currently invincible use scroll bars.

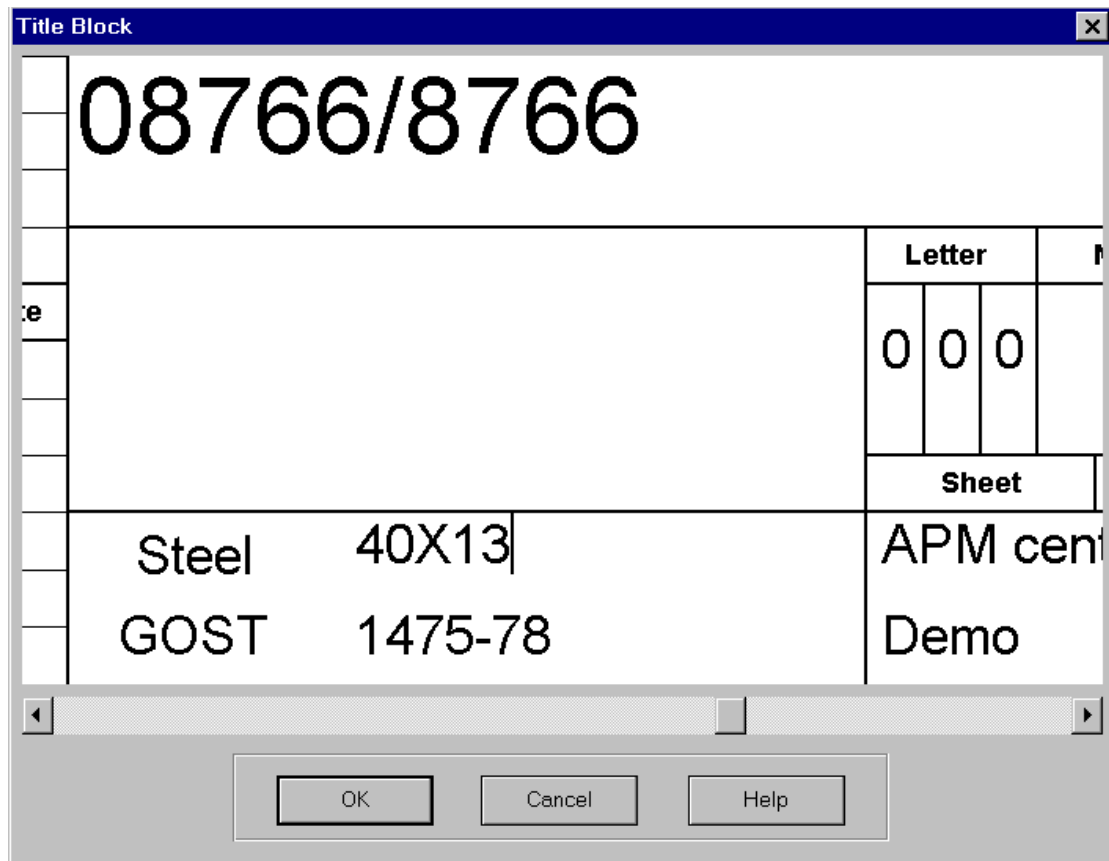


Fig. 6.17 The Title Block dialog box

Angular step entering

To enter the angular step of cam profile coordinates select *zone 3*. The dialog box shown in fig 6.18 will be shown. The step should be within the range of 10.. 30 degrees.

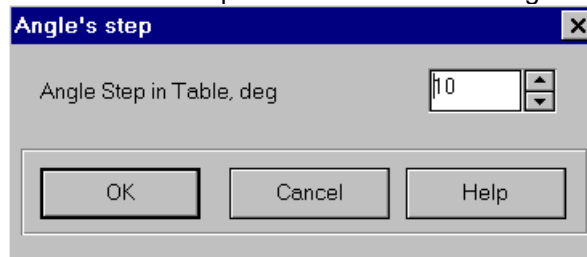


Fig. 6.18 The Angular Step dialog box

Specification input

To enter the specifications you should activate *zone 4*. The dialog box is displayed (fig.6.18) where you can enter corresponding parameters (see chapter 1 for the list of specifications).

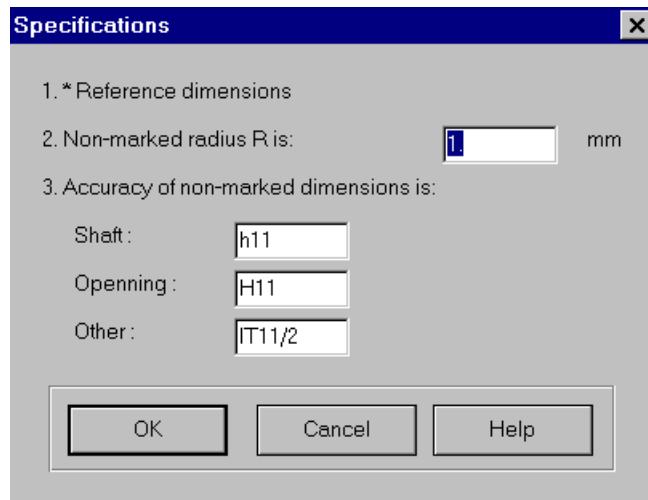


Fig. 6.19 The Specifications dialog box

Drawing generation

To generate drawing select **Save As** button, that becomes available after you specify cam construction in the *Zone 2*. This command invokes standard *File Save* dialog box. By selecting *Ok* button in this dialog box you start drawing generation.

Help menu

Help popup menu (Fig. 6.20) contains commands that

- call APM Cam help system
- display *About Cam* dialog box

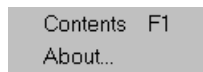


Fig. 6.20 The Help popup menu

Help command

Help | Contents command invokes window with APM Cam help contents. Select topic of your interest and click it with mouse or press ENTER key. In fact, when you call help in application program that runs under Microsoft Windows, the special program in Windows starts (WINHELP.EXE). This is a sophisticated hypertext system, that provides you with versatile tool for reference information retrieving. For detailed information about Windows help system please refer to your Microsoft Windows User's Guide. To get online information use **Help | How to Use Help** command in the menu of help system.

Shortcuts

Keys F1

About Cam command

Help | About Cam command calls *About Cam* dialog box on the screen. It displays the program name and the version together with the license information.

Toolbar

The toolbar is the group of pictographic buttons located below the main menu (Fig. 6.21). The toolbar is intended to speed up selection of some frequently used commands.



Fig. 6.21 APM Cam toolbar

The buttons of the toolbar initiate the following commands (from left to right):

- File | Load
- File | Save
- File | Print
- Data | Type
- Data | Geometrical data
- Data | Physical data
- Data | Function
- Calc
- Results
- Acad

To execute command with speedbar simply click the appropriate button with mouse.

Accelerators

Accelerator is the combination of the keys used to speed up command selection. In the APM Cam the following accelerators are used.

Command	Accelerator
File Load	CTRL+L
File Save	CTRL+S
File Print	CTRL+P
File Exit	CTRL+X
Data Type	CTRL+T
Data Geometrical data	CTRL+G
Data Physical data	CTRL+I
Data Function	CTRL+F
Calc	CTRL+C
Results	CTRL+R
Acad	CTRL+A
Help	F1

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