

ИНЖИНИРИНГ ПРОЧНОСТЬ ВИБРОЗАЩИТА И СЕЙСМОСТОЙКОСТЬ



CKTI-VIBROSEISM

A STRUCTURAL-MECHANICAL CONSULTING ENGINEERING FIRM

Introduction to dPIPE 5.

Quick Start

Version 2.6.0



Saint Petersburg © 2018 CKTI-Vibroseism

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1 Introduction

The present document is intended for a quick introduction to dPIPE 5 and its basic operations. Below you can find a short description of its interface and hot keys. A <u>test model</u> exemplifies recommended work algorithms and methods of developing a calculation model, entering input data, establishing options for analysis and post-processing, performing analysis, viewing and assessing its results. The given model is restricted to only 30 nodes, so that it can be viewed within the demo version of the program.

1.1 Installing software

In order to install dPIPE 5 on your computer, launch installation program dp5_setup.exe and follow its instructions. You will be asked to choose the interface language for the installer, disk space to save it to, as well as the interface language for dPIPE.

The installer can be either included in the installing package provided to the User upon purchasing dPIPE or downloaded from the website <u>www.dpipe.ru</u> (section "<u>Files for download</u>").

To access the full functionality of the program, one needs a security key (either hardware or software, either user or network).

Without security key, the program only operates in demo mode. In this case, its full functionality is limited to 30 nodes of calculation model.

dPIPE 5. Tutorial

1.2 Test model

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Let's take a look at the test model of Feedwater piping stretching from a pump into a header.



Open dPIPE and take a closer look at the main window of the program.

1.3 Main window

Menu and the toolbar are located in the upper part of the main window, while the graphics window and spreadsheet for entering piping geometry are located in its lower part. The spreadsheet could be switched on/off from the menu "Main Data/Layout"

Introduction	5
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(i) dPIPE 5.26 (Build: 06 Aug 2017)	-	٥	×
File Edit View Tools Analysis Utilitee Main Data Additional Data Help			
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<u>10</u>			
0			
Tig range flag marking the			
A			
coordinate axes Graphic window			
			- a x
Node Bernent Table "Geometry" dY dZ Add Data Section Load Group Comment			
110 prom 0 0 Ppp1 LG1			_
Graphics	display		
paramet	ers		>
Create New Model Turn: -45° Slope: 35° Scale	: 1.000 Scale	e D: 1.0 🖉	P

In order to start, choose the Piping Code.

2 Quick start

This chapter provides information on how to create a simple model of the piping and run an analysis. The User is offered to build one branch of the <u>test piping model</u> between two anchors (from s4 to s9) following this guide

2.1 Piping Code

Since the data relevant to the piping model depend on the respective piping Design Code or Norms, it should be defined first of all.

Open menu "Tools" and choose "Options":



A dialogue window shall appear. In folder "Control parameters", choose "Code".

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Piping Code Reports Control Parameters Main Dynamic Code Hangers & Supports Specifications Graphic Layout Piping Code Vear 2012 ASME_B311 ASME_B311 ASME_B314 ASME_NC NUT NASI PNAE	Ontines	×
Files Reports Control Parameters Main Dynamic Code Hangers & Supports Specifications Graphic Layout Piping Code Year 2012 ASME_B311 ASME_B314 ASME_NC Nut ENB ASME_NC Nut ENB Bernerstowers Elasticity Modulus Flexibility for tee joints ASME ASME HOT CODE CODE	Options	
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OK Cancel Help		OK Cancel Help

In the input field "Code", choose "EN" and click "OK".

Next step is to define an appropriate data for the piping sizes (cross-sections) used in the model.

2.2 **Pipe cross-sections**

In <u>the main window</u>, use command "Pipe Sections" from the menu "Main Data". The following window shall open:

Pipe Section	Pipe Sections. Code: EN X													
	Name	Diameter	Wall Thickness	Weight of pipe	Material	Insulation Weight								
✓ 1 Pipe1		100	8	0.177999	Material1	0 1								
	2													
			m			•								
Std. bend	Name	Radius	S	ection										
14 4 F FI	Bends	•/												

Press button



■ to import from database

For Users' convenience, dPIPE is supplied with a set of databases containing different sizes of pipes and fittings along with materials used at nuclear and conventional power plants. These data are Code – dependent and are compiled in an editable text format (refer to files PIPE.dbs & MAT.dbs). These databases may be updated by the User.

The following dialogue window shall appear:

Name 👻	Diameter 🗃	Wall Thickness	*	Material 👻	Document -	
P200	219			P265GH_t40	EN10253-2:2007	
°250	273		25	P265GH_t40	EN10253-2:2007	

Choose sections P250 and click "Add":

The window "Pipe sections" now has a new entry. Expand the window to see all the lines:

Pipe Sections. Code: EN X														
	Name	Diameter	Wall Thickness	Weight of pipe		Material	Insulation Weight							
✓ 1	P250	273	25	1.53	P265GH_t40		0.3	No						
	2													
Std. bend	Std. bend Name Radius Section													
1	3D	381	P250											
2	5D	650	P250											
H 4 🕨 H	Bends	s/												

The upper part of the table provides data on the pipe's sizes, while the lower - on the standard fittings matched above sizes.

Note: the decimal symbol used in dPIPE is independent of Regional Settings and always is a dot (.)!!!

In the column "Insulation weight", enter weight for each section in N/mm: 30 kg/m ~ 0.3 N/mm.

■ Cross-section "Pipe1" cannot be deleted now

This data could not be deleted since this section is in use (it's referenced by piping layout). The same principle is used with other data: the program protects it from deleting if they are referenced somewhere...

In the lower window "Layout", double-click the left mouse button on field "Cross-section" (where "Pipe1" is written).

ų	Layout										÷ 4 ×
1	N	lode	Element	L/R	dX	dY	dZ	Add. Data	Section	Load Group	Comment
	1 10	F	rom		1	0	0		Pipe1	LG1	
1											

Window "Select Pipe section" shall appear:

Select Pipe Section	×
Pipe 1	Property
Pipe1 P250	Data Base
	ОК
	Cancel
	Help

Choose P250 press OK.

■ Alternatively...

From the same dialogue there is a way to edit section's properties (select required section and press "Property" button) or adding the new one (just type new name and press OK, or select existing from the Data Base)

Input data can now be entered into table "Layout":

\$	Layout										→ ‡ ×
1		Node	Element	L/R	dX	dY	dZ	Add. Data	Section	Load Group	
Þ	1	10	From		1	0	0		P250	LG1	
		2						L			
	•			III							+
_											0

Now, section "Pipe1" can be deleted from the table "Pipe sections". Click the right mouse button on row "Pipe1" and choose "Delete rows" in the drop down list.

Pipe Section	ns. Code: EN								×
1	R								
Name Diameter				Wall Thickness Weight of pipe			Material	Insulation Weight	
✓ 1	Pipe1	100		8 0.177999 Mate			al1	0	=
2	2 P200		88	Find	c	trl+F	H_t40	0.25	-
3	3 P250			H_t40		H_t40	0.3		
	1			Insert Ru	nvv				-
•			•	Delete ro	ows Ct	rl+D		+	
Std. bend Name Radius				s	ection		1		
	2								

Close table "Pipe sections" and move on to table "Layout".

2.3 Piping layout

Enter 0, -1, 0 into fields dX, dY and dZ respectively. Then double-click the left mouse button on field "Add. data" (or use shortcut key "F2"). A dialogue window shall open. From the left list choose "Anchor" and either press the button with right arrow or double click the left mouse button on "Anchor" - an anchor shall appear in the node.



Press "OK", and the window shall close.

To continue entering input data, move on to the next row and enter **6000** in field "L/R". This value represents the length of a piping section given in mm between anchor and sliding support. Upon pressing "ENTER", field "Node" shall have a new marking of node "20".

Enter data for a sliding support in a similar way to the anchor data in the same row in the field "Add. data":

🚳 dPIPE 5.26 (Build: 09 Jun 2018) - Model		1 22
File Edit View Tools Analysis Utilites Main Data Additional Data Help		
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	13 🚸 4	R [
Node "20"		
Data types: Data:		
Z Anchor D. Force		
Damper Force		
TT X		
Rigid Strut Rod Hanger		
Layout Snubber		▼ ‡ X
No Spring Hanger	Add. Data	
1 10 OK Cancel Help	Anchor	P250
		4
Ready Turn: -45° Slope: 35°	Scale: 1.000	Scal 🔡

In field "L/R" of the third row enter 1700. An image of a pipe section should appear in graphic window between the toolbar and table "Layout".

The program working in two modes: the mode of dynamic drawing, when input data is checked simultaneously, and passive mode without checking and drawing. Switching between these two modes can be performed using either command "Tools" - "Redraw dynamically", or a hotkey combination "Ctrl+F5", or the button "Redraw dynamically"



Then, move on to the next row, double-click the left mouse button on field "Element" (or press "F2"). Choose "Bend" in the dialogue window and press "OK". After that, double-click the left mouse button on the "L/R" box and choose type of bend "5D" from the drop-out list

🚱 dP	IPE 5.26 (Bu	ild: 09 Jun 201	8) - Model						
File	Edit Viev	w Tools An	alysis Utili	ites Main Data	Additional Da	ta Help			
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	X	Node	Element	L/R	dX	dY	dZ	Add. Data	▼ ⋣ ×
	X Layout 1	Node 10	Element	L/R	AP 0	dY -1	dZ 0	Add. Data Anchor	▼ ₽ × P250
	X Layout 1 2	Node 10 20	Element From	L/R 6000	dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	► # × P250
	Layout 1 2 3	Node 10 20 30	Element From	L/R 6000 1700	0 Xb	dY -1	dZ 0	Add. Data Anchor Sliding	▼
 ○ □ = > ▲ ♦ × 	Layout 1 2 3 4	Node 10 20 30 40	Element From Bend	L/R 6000 1700	dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	► # × P250
	X	Node 10 20 30 40	Element From Bend	L/R 6000 1700 50 v 3D 50 v	dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	► # × P250
	X Layout 1 1 2 3 4	Node 10 20 30 40 	Element From Bend	L/R 6000 1700 5D 5D	dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	▼

Enter 1 in the "dX" box.

It is convenient to move between table cells using arrow keys (left - right and up - down arrows on the keyboard).

Move on to the next row, enter 4000 in the cell "L/R" and save the model.

Now let's consider how to set or redefine direction for a piping segment and build the rest of the model.

2.3.1 Saving the model

Choose the working directory, for instance, C:\work\ and save the model using a standard Windows dialogue. It is not recommended to save files in the dPIPE installation folder.

In menu "File", select "Save" or press the floppy disk button:



It's recommended to save the model time to time during the working session. By default, the program automatically saves the backup copy of the model every 5 minutes Autosave time may be adjusted from the Tools/Options menu, tab "Control Parameters/Main":

Options				×
	Model Title			
Reports				
⊡ Control Parameters <mark>Main</mark> Dynamic Code	Ambient Temperature	20	Maximum Number of Iterations	99
Hangers & Supports Specifications Graphic Layout	Friction Scale	1	Lift-off Criteria	2
	Minimal Bend Angle	5	Transition Stiffness	1e+009
	Minimal element length	1	Rotation Stiffness	1e+014
	Model autosave time in minutes. 0 for disable autosave	1		
				Reset
	OK Cancel	Help		
and in the case of program's fail	ire may restore	it. However,	User should be	e aware, that there
is no "undo" functionality in the v model use "File" - "Last saved fil	vorking with lay e" (or press "Ci	yout's spread trl-T")	lsheet. To rest	ore the last saved

Let's continue creating the model

2.3.2 Assigning direction

Press "Ctrl+Shift+I" or "Ctrl+A" or respective buttons on the toolbar (





■ More about graphic window...

If some symbols of supports are missing in shown figure, press "F3" (or do it via menu items "Tools" -> "Options ..." -> "Graphic layout" -> "Display Options") and check the appropriate boxes:

Options		X
 Files Reports Control Parameters Specifications Graphic Layout Display options 	Elements being displayed Points for Nodes [Shift+P] Labels for Nodes [Shift+N] Weights [Shift+L] Forces and Moments [Shift+F] Hangers [Shift+R] Spring Hangers [Shift+H] Anchors [Shift+A] Supports [Shift+S] Restraints [Shift+J] Slidings [Shift+1] Elect/Deselect all	 Guides [Shift+G] Tees [Shift+T] Dampers [Shift+D] Snubbers [Shift+U] Welds [Shift+W] Welds [Shift+H] Gaps [Shift+B] Dynamic Forces [Ctrl+Shift+F] Rigid Struts [Shift+C] Geometric Links Expantion Joint Type
	Auto position on current element 333 Current element blink rate (ms) OK Cancel Help	Labels for Extra Data 1 Additional Data Scale Factor

Here is a piping segment, consisting of 4 elements and 5 nodes. The piping starts at node 10 ("From" command), where a fixed support (Anchor) is installed and is directed to -Y (-1 along the Y-axis). After 6000 mm, a sliding support (Sliding) is put in node 20. After another 1700 mm, the piping changes its direction. The new direction is + X (1 along the X-axis). The direction is changed at the bend (5D). The piping continues in the + X direction for 4000 mm to node 50. Let's look at the location of nodes 30 and 40:



It should be noted: the length of any elements before or after BEND is measured as a distance between element's starting (or ending) node and the point of intersection of tangents to the bend's arc.

Let's continue entering the piping geometry up to the next fixed support.

2.3.3 Continuing to build the model

Move to the next row after node 50 and select "Bend" in the "Element" column. Select "5D" in the "L/R" column. In the dY field, type in "-7400" and press "Ctrl + Enter". Move the cursor to

node 60. Press "Ctrl+Shift+I" or "Ctrl+A" or the appropriate buttons on the toolbar (



). The following image shall appear:

🔯 dP	PIPE 5.26 (Build:	09 Jun 20	18) - Model								X
<u>F</u> ile	<u>E</u> dit <u>V</u> iew	<u>T</u> ools A	<u>n</u> alysis <u>U</u> tilite	s <u>M</u> ain Data	<u>A</u> dditional Da	ita <u>H</u> elp					
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ð											
山							40 30				
Ø	Z				1 ~	50	,				
T			The	e current eleme	ent						
=	x	Y	hi (pr the model is ghlighted by re- usor is placed	d)				₩10		
	x	1	hi (cu ca	or the model is ghlighted by re ursor is placed urresponding ro	d in W				*10		
	×	`	hi (cu co	or the model is ghlighted by re irsor is placed irresponding ro	d in W				*10		
	Layout	~~		or the model is ghlighted by re ursor is placed rresponding ro	d in w				*10		▲ 廿 ×
	Layout	Node	Element	L/R	d in w dX	dY	dZ	Add. Data	¥10	ction	▼ ₽ ×
	Layout	Node	Element From	L/R	d in w dX 0	dY -1	dZ 0	Add. Data Anchor	¥10 Sec P250	ction	▼ # × L ▲ LG
	Layout	Node	Element From	L/R 6000	d in w dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	¥10 Sec P250	ction	▼
	Layout	Node	Element From	L/R 6000 1700	d in w	dY -1	dZ 0	Add. Data Anchor Sliding	¥10 Sec P250	ction	▼ # × LG □
	Layout	Node	Element From Bend	L/R 6000 1700 50 6000	d in we	dY -1	dZ 0	Add. Data Anchor Sliding	¥10	ction	▼
	X Layout 1 10 2 20 3 30 4 40 5 50 2 50	Node	Element From Bend	L/R 6000 1700 5D 4000	d in w dX 0	dY -1	dZ 0	Add. Data Anchor Sliding	¥10	ction	▼
	X Layout 1 10 2 20 3 30 4 40 5 50 6 60 7 70	Node	Element From Bend Bend	L/R 6000 1700 5D 4000	d in w dX 0	dY -1 0 -7400	dZ 0	Add. Data Anchor Sliding	¥10	ction	▼
111 M 🚽 🛊 💥 🖉 ի 候 🔰	Layout Layout 1 10 2 20 3 30 4 40 5 50 6 60 6 70 	Node	Element From Bend Bend	L/R 6000 1700 5D 4000 5D 0	d in w d X 0 1 1 0 0	dY -1 0 -7400	dZ 0	Add. Data Anchor Sliding	¥10	ction	×
	X Layout 1 10 2 20 3 30 4 40 5 50 6 60 7 70 4	Node	Element From Bend Bend	L/R L/R 6000 1700 5D 4000 5D 0	d in w dX 0	dY -1 0 -7400	dZ 0	Add. Data Anchor Sliding	¥10	ction	▼

Note: the direction of piping is defined in DX/DY/DZ fields and assigned in the rows with nodes 10 and 40 by means of the direction cosines. The length of elements is specified at nodes 20, 30 and 50, respectively. At node 60, the length is specified in the direction field. But node 60 is the point, where the piping changes direction. Next element (Node 70) after the BEND was added with a length of zero. If one specifies a non-zero length, the program will ignore value and will normalize numbers to the directional cosines...

On the sixth row (node &0), press "Ctrl+Enter". Node 80 shall appear between nodes 60 and 70. Enter length "**1700**" in the "L / R" field. This will be the location of node 80 relative to node 60 along the -Y axis. A total distance of 7400 mm will remain unchanged. Therefore, the distance between node 80 and node 60 will be 7400-1700 = 5700 mm.

Distance measurement

In the graphics window, click the right mouse button and, if not selected, select items "Show nodes", "Show node labels" in the pop-up menu. Select "Distance measurement" from the pop-up menu:

File Edit View Tools Analysis Utilities Main Data Additional Data Help Image:	🛐 dP	IPE 5.26	ō (Build	: 09 Jun	2018) - N	lodel									-			×
Image: Section Image	File	Edit	View	Tools	Analysis	Utilites	Main Data	Additiona	al Data	Help								
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2 2	4	<i>></i>	i iii			•	‡ 🧭 🎙	1 🗹 3	/	8 🗭	😵 🖉 🏏	- (3 -	ا	. Q	🖹 🕺	0 0 b	8 2	Ŧ
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Image: Solid Constraints Image: Solid Constraints Image: Solid Constraints Move Image: Solid Constraints Scale Image: Solid Constraints Solid Constraints Image: Solid			Î							47	Rotate			1				
Layout Scale Layout 3D View Ctrl+F10 Node Bement L/R dX Show Nodes Shift+P 1 10 From 0 Show Node Labels Shift+N 2 20 6000 P Show Node Labels Shift+N 3 30 1700 P Quick Info E 4 40 Bend 5D 1 P Distance Measurement E	_	x_	\nearrow	Y							Move			×	10			
▲ Image: Source of the section of	_									-510r	Scale							
Layout 3D View Ctrl+F10 Node Element L/R dX ✓ Show Nodes Shift+P Section L 1 10 From 0 ✓ Show Nodes Shift+N 50 L/G 2 20 6000 ✓ Show Node Labels Shift+N 50 L/G 33 30 1700 🕞 Quick Info 4 40 Bend 5D 1 Distance Measurement														-				
Node Bement L/R dX Show Nodes Shift+P Section L/ 1 10 From 0 50 L/ 10 L/ 10 L/ 10 L/ 10<	1	Layout								- 22	3D View		Ctrl+F10				• 1	ιx
Image: Normal System Image: Normal System <td>T</td> <td></td> <td></td> <td>Node</td> <td>Ele</td> <td>ement</td> <td>L/R</td> <td>dX</td> <td></td> <td>~</td> <td>Show Nodes</td> <td></td> <td>Shift+P</td> <td></td> <td>Section</td> <td></td> <td></td> <td>1 -</td>	T			Node	Ele	ement	L/R	dX		~	Show Nodes		Shift+P		Section			1 -
2 20 6000 3 30 1700 4 40 Bend 5D 1 5 50 4000 Distance Measurement Image: Comparison of the state of	×		1 10		From				0	~	Show Node Labe	els	Shift+N	50			L	.G
3 30 1700 Image: Constrained of the second	<i>[</i>]		2 20				6000				Outide Infa							
K 55 50 4000	T		3 3U		Bend		50		1		QUICK INTO							-
1000	X		5 50	·)	Dene		4000		-	1	Distance Measur	rement		<u> </u>				-
7 6 60 Bend 5D 0 Selection	1		6 60)	Bend	1	5D		0	~	Selection							
7 80 1700 Group operations with supports	✓		7 80)			1700				Group operation	ns with sup	oports 🕨					-
		•	-		III													P .

Move the cursor to node 80 and click the left mouse button, then move it to node 70 and click the left mouse button again. The information window will appear:

Information			x
			*
The distance bet	ween nodes "80" an	d "70": 5700.0	
Xb	dY	dZ	
0.0	-5700.0	0.0	
			Ŧ
	Close		



The same pop-up menu offers commands "Rotate", "Move", "Scale". To change the pivot

point, press "Ctrl+E" or button \square . Changing scale can be done by moving the mouse in different directions or by scrolling. The same commands can be performed using the keyboard: rotation - by the cursor arrows, movement - by the cursor arrows with pressed button "CTRL", scaling by buttons "+"/"-".

Add anchor to node 70 and sliding support to node 80.

Add node 90 before anchor at distance 4.9 m. To do that, move to the line with node 70, enter 4900 at "L/R" field and press \Box "Ctrl+Shift+Enter"

Ŭ													
4	40	Bend		5D	1		0	()				
5	50			4000									
6	60	Bend		5D	0	-	7400	0)				
7	80			1700									
8	70			0			_						
	2		88	Find		Ctrl+F							
	3			Show ele	ement Ctrl	+Shift+E							
•		111		Insert Ro	w	•	ŧ	Above	Ctrl+Shift	+Enter		_	Þ
Row above			•	Delete ro	ows	Ctrl+D	+	Below	Ctrl	+Enter	Scale D: 1.0	P	đ

the same action may be arranged from the mouse context menu:

This action splits existing element "80-70" in two parts: "80-90" and "90-70":

Layout									ф,	×	
	Node	Element	L/R	dX	dY	dZ	Add. Data	Section	1	1	
1	10	From		0	-1	0	Anchor	P250	LG	;	l
2	20		6000				Sliding				l
3	30		1700								l
4	40	Bend	5D	1	0	0				=	l
5	50		4000						Τ		l
6	60	Bend	5D	0	-7400	0					l
7	80		1700				Sliding				l
8	90		0								l
9	70		4900				Anchor				
	1									Ŧ	
•	1	11							. F		

The distance between nodes 80 and 90 is 7400-1700-4900 = 800 mm. By inserting the intermediate nodes, we did not affect the overall length of the pipeline.

If there is a zero in the "L/R" column, the values in the directions fields "dX, dY, dZ" are considered as the a total length of the straight section, and the actual length of the element with L = 0 is calculated as difference between the total length and sum of lengths for all elements located between two points that change direction. Two zeros along straight run are not allowed

In conclusion, let's consider another useful way to enter the pipeline layout. Double-click on the table header in column "dX", "dY", or "dZ". The table will move from Cartesian to spherical coordinates. In node 40, enter the angle "Theta" = "-15" degrees, radius r = "4000", in node 50, enter "0".

Layout									🔻 🕂	×
	Node	Element	L/R	Fi°	Theta°	r	Add. Data	Section	Load Group	*
1	10	From		-90	0	1	Anchor	P250	LG1	
2	20		6000				Sliding			
3	30		1700							
4	40	Bend	5D	0	-15	4000				=
5	50		0							
6	60	Bend	5D	-90	0	7400				
7	80		1700				Sliding			
8	90		0							
9	70		4900				Anchor			
•	i /							1	۴.	Ŧ

Now the pipe section along the X axis is inclined on 15 degrees to the horizon. The length of the section is still 4.0 m. This option is especially useful for the modeling bends with an angle of 15, 30, 60 degrees. Double-click the right mouse button on the table header in the "Fi" or "Theta" or "r" column and return to the Cartesian coordinate system.

Layout	yout 👻 🕂 🗶											
	Node	Element	L/R	dX	dY	dZ	Add. Data	Section	Load Group	<u>^</u>		
1	10	From		0	-1	0	Anchor	P250	LG1	-		
2	20		6000				Sliding			-		
3	30		1700							-		
4	40	Bend	5D	3863.7	0	-1035.28				=		
5	50		0									
6	60	Bend	5D	0	-7400	0		1		-		
7	80		1700				Sliding			-		
8	90		0							-		
9	70		4900				Anchor			-		
										Ψ.		
•									•			

The program automatically calculates dimensions along X and Z axes.

In addition, a simple calculator is built into the table: enter "7400-1700-4900" in the "L/R" column in the 8th row (node 90) and press "Enter", in the 9th row, enter "0".

To rename node 80, place the cursor on this number (7th line, 1st column) and enter "62".

Layout									👻 🕂	x
	Node	Element	L/R	dX	dY	dZ	Add. Data	Section	Load Group	*
1	10	From		0	-1	0	Anchor	P250	LG1	
2	20		6000				Sliding			
3	30		1700							
4	40	Bend	5D	3863.7	0	-1035.28				Ξ
5	50		0							
6	60	Bend	5D	0	-7400	0				
7	62		1700				Sliding			
8	tee_1		800							
9	70		0				Anchor			
										Ŧ
•									•	

Rename node 90 to node "tee 1".

Now we will suspend entering data for the piping layout and will consider the setting of the <u>operation modes</u>, options for analysis and execution of analysis.

2.4 Operation modes

Choose command "Main data" - "Operation modes" (or press) in order to assign medium operating parameters. In dPIPE 5, pressure is in MPa, temperature is in Celcius degrees, density of the medium is in fractions of water density.

Opera	tional Modes								×
	Name	Lifetime, thous.		Name	Р	Т	CSG	INS	Tau
∨ 1	OPVAL1			IG1	18.4	215	1	1	
	2					2.0			
•	111	•	•			III			F.

Enter P =18.4 MPa, T=215°C, CSG=1.

■ Please, note:

Marking LG1 (LG = Load Group) is used by default to assign piping sections with such parameters. Operation mode "OPVAL1" is a marking used by default to specify the operation mode.

Enter parameters for the hydro-testing mode. Place the cursor onto "OPVAL1" and press "Ctrl+Enter". Operating mode "OPVAL2" shall appear. Rename it as \blacksquare "TEST".

"TEST" is a predefined name for the hydro-testing mode. One can name it differently, but then has to change the reference in the standard set for analysis specification.

Enter P =22.55 MPa, \Box T=20°C, medium is water (CSG=1). *Hydro-testing temperature of 20°C corresponds to the default installation temperature.*

Opera	tional Modes								×
	Name	Lifetime, thous.		Name	Р	Т	CSG	INS	Tau
1	OPVAL1			I LG1	22.55	20	1	1	
∨ 2	TEST			2 📝					
	2			-					
			,						
•		F	•			111			F

Close this table and determine the analysis specification and postprocessing of results.

2.5 Analysis specification

To check the Code compliance and define piping response under specified loading dPIPE performs set of analyses. Each analysis within the program is called a Load Case. In the post-processing stage, the program uses results of analyses to calculate the piping stresses, support's reactions, piping deflections, etc. Each post-processing directive is called as Load Set.

dPIPE provides a predefined set of the standard sequences of directives for analyses and postprocessing. These options may be downloaded from the database (data is stored in solv.dbs file). In the "Main Data" menu, choose "Analysis specification" and press the "Import from Database" button:

Analysis Spo	ecification (Unt	itled). Code: EN.							×
😿 🕅	🗰 🗰 🗇	ir -							
Name	Туре	Mode	Load	Pend.	Fric.	NLS	Hng. Stf.	PE	
	2								
			Ex	port to					,
Postprocess Name	Type	Rule	Print Da	taBase 🚽		Comm	ant		
Name	- 19pc	nuic		· V	Preview	- Comm	un.		
		Edit Title	💗 🕅 冢 🚽	🔹 🕞 👘	as a te	xt			
				16					
			Code Dat	TT Trom					
		L. L		abase					
•									Þ.

Choose the following item from the list: "#1+HTEST". Press OK:

Sele	ct Analysis Specifications	×
£	#1 #1+HTEST #1+SEISM	OK Cancel
		пер

In order to see the analysis specification commands, press "View as text":

Preview
SOLV "Spring Design + HTest. Stress Analysis (#1)"
& LC mod = '\$OPER', type = 'DSGN', note = "Spring Hangers Design Loads" ; LC1
& LC mod = '\$OPER', type = 'OPER_A', fric = 'No', pend = 'NO', note = "Hot Loads for spring design" ; LC2
& LC mod = '\$COLD', type = 'OPER_B', fric = 'No', pend = 'NO', note = "Cold Load. Selection of springs" ; LC3
& LC mod = '\$OPER', type = 'OPER_B', pend = 'YES', note = "Hot Load. Stage II" ; LC4
& LC mod = '\$OPER', type = 'SUST_C', note = "Sustained Loads. Stage I. " ; LC5
& LC mod = '\$COLD', type = 'OPER_B', pend = 'YES', note = "Cold Load. Stage IV" ; LC6
& LC mod = 'TEST', type = 'TEST', pend = 'YES', note = "Stage II (Hydro)" ; LC7
& LC mod = 'TEST', type = 'SUST_C', note = "Stage I (Hydro)" ; LC8
POST
& res = 'SGM1', ls = "LC5", note = "SGM1" ; LS1
& res = 'SGM1T', ls = "LC8", note = "SGM1T (HTEST)" ; LS2
& res = 'SGM3', ls = "LC4-LC6", note = "SGM3" ; LS3
& res = 'SGM4', ls = "LC5+LS03", note = "SGM4" ; LS4
& res = 'DISP', ls = "LC5", note = "Weight deflections" ; LS5
& res = 'DISP', ls = "LC4-LC6", note = "Thermal expansions" ; LS6
& res = 'DISP', ls = "LC8", note = "Hydro Test Displacements" ; LS7
& res = 'SUPP', ls = "LC4", note = "Hot Loads"; LS8
& res = 'SUPP', ls = "LC6", note = "Cold Loads"; LS9
& res = 'SUPP', 1s = "LC7", note = "Hydro Test Loads"; LS10
POST REP load hot = 'LC4', load cold = 'LC6', load des = 'LC1'

∃ Steps..

A first three Load Cases are intended for the selection of the springs used in the variable spring supports or hangers (if any). Next, LC4 calculates piping response in the hot state. LC5 defines internal forces used for the checking the code equation under sustained loads (SGM1 in the post-processing section). LC6 provides results for the cold state. LC7&LC8 are used for the hydro-test.

L.

Close the "Analysis Specification" window and launch the analysis.

2.6 Run of analysis

Choose menu "Analysis" - "Batch mode" or press to save the model. Choose "Yes".

The analysis execution window shall appear:

on the toolbar. The program shall ask

File C:\WORK\Model.bin was created successfully.Solve > Op 1(R): WSolve > Op 1(A): W+P+T+DSolve > Cold(B): W+P+T+DSolve > Op 1(B): W+P+T+D+FR+SWSolve > Op 1(C): W+PSolve > Op 1(C): W+PSolve > Cold(B): W+P+T+D+FR+SWSolve > Cold(B): W+P+T+D+FR+SWSolve > Op 2(C): W+PSolve > Op 2(C): W+PSolve > Op 2(C): W+P	
dPIPE 5 Post Apr 11 2018 POST: LS1SGM1LC5 SUM POST: LS2POST: LS2SGM1TLC8 SUM POST: LS3POST: LS3SGM3LC4-LC6 SUM POST: LS5POST: LS5DISPLC5 SUM POST: LS6POST: LS6DISPLC4-LC6 SUM POST: LS7POST: LS8SUPPLC4 SUM POST: LS8POST: LS9SUPPLC6 SUM POST: LS9POST: LS10SUPPLC7 SUM Stop - Program terminated. Press eny key to continue	
	<u>اند</u> ۲

The last line prompts the User to press any keyboard key to close the analysis execution window.

The analysis is complete, so one can view the results.

2.7 View the results

The results can be viewed either in a text or in a graphic format.

In order to view full text report, press (menu "Analysis" - "View Results of Analysis"). To

view spreadsheets with support loads, press *menu* "Analysis" - "View Support Loads").

To view results in a graphic format, use the Pipe3DV software. To install it, press (menu "Analysis" - "Pipe3DV").

2.7.1 Listing of results

Upon completing the analysis, dPIPE generates several text files, which are kept within a folder with the piping calculation model.

File with extension <model name>.res contains a full listing of the analysis results, based on the

post-processing commands (POST). To open this file, press (menu "Analysis" - "View Results of Analysis").

The opened window shall contain general information relation to the analysis options, as well as tables with results data. The last section of the file is named "Summary Tables with Results of Analysis", in which the values of the maximal displacements, support's reactions and stresses within piping elements are provided:

C Mo	del.res - W	/orkPa	d	-	-	_				_		x
<u>F</u> ile	<u>E</u> dit <u>V</u> iev	v <u>H</u> el	lp									
****	******	****	**** Sl	JMMARY	TABLES	WITH RES	SULTS OF	- AN/	ALYSIS ****	***	****	*
>>> 1	Table	17.	Maximal	stress	es SGM	1 (susta	ined loa	ads)		+	qualified	
elem.	node1	L 	node2	ana	lys a	11ow.	FS	- 4	<sgm1></sgm1>			
PIPE BEND	10 50		20 60		57 53	124 124	0.46 0.43					
>>> 1	Table	18.	Maximal	stress	es SGM	1T (proof	test o	ond	itions)	+	qualified	
elem.	node1	L 	node2	ana	lys a	11ow.	FS	- *	SGM1T (HTE	ST)>		
PIPE BEND	10 50		20 60		67 64	242 242	0 .28 0.26	-				
>>> 1	Table	19.	Maximal	stress	es SGM	3 (stress	range))		+	qualified	
elem.	node1	L 	node2	ana	lys a	11ow.	FS	- 1	<sgm3></sgm3>			
PIPE BEND	20 30		30 40		93 94	188 188	0.49 0.50	_				
>>> 1	Table	20.	Maximal	stress	es SGM	4 (stress	s range))		+	qualified	
elem.	node1	L 	node2	ana	lys a	11ow.	FS	-	<sgm4></sgm4>			
PIPE BEND	20 30		30 40		144 145	312 312	0.46 0.47	-				
>>>	Table	21.	Maxima	l displ	acemen	ts.						
Node		х	Y	z	xx	YY	ZZ	2				
	50 30 50	-12 0	-17 0	0 -1 0	-0.00 0.00 -0.00	0 -0.00 1 -0.00 0 -0.00	00 0. 02 0. 00 0.	000 003 000	Weight def Thermal ex Hydro Test	lections pansions Displacer	nents	
Notes X,Y,Z XX, Y	s: z YY, ZZ	- di - ro	splaceme tation,	ents, m rad;	m;							
>>>	Table	22.	Maxima	l suppo	rt's r	eactions.						Ε
Node	typ	pe c	S FX	(A)	FY(H)	FZ(N)	M)	(A)	MY(H)	MZ(N)		
				Hot	Loads							
70 10 62	and and sli	ch G ch G id G	222 -237 32	257 - 788 244	63986 60810 5030	-9693 -2915 -20058	-12	2376 -759	-5928 -4632	-58609 -69899		-
•												
										Ln 359, Col 4	8 CAP NU	M La

In case if calculated stresses exceed allowable ones, the respective line of the listing has an exclamation sign "!", and the spreadsheet title is marked "- not qualified". Using these indicators

Model.res - WorkPad <u>File Edit View H</u>elp 17. Maximal stresses SGM1 (sustained loads) qualified >>> Table elem. node2 analys allow. FS <SGM1> node1 PIPE BEND 10 20 71 57 124 0.57 124 30 40 0.46x Find not qualified conditions) qualified >>> 1 Find what: Find Next <SGM1T (HTEST)> elem. Direction Cancel PIPE O Up O Down Match case BEND >>> Table 19. Maximal stresses SGM3 (stress range) not qualified analys elem. node1 node2 allow. FS <SGM3> PIPE PIPE PIPE 10 20 211 188 1.12 Ε 20 30 281 188 1.49 261 1.39 1.02 60 62 188 PIPE 62 tee_1 191 188 BEND 30 40 281 188 1.49 BEND 90 60 261 188 1.39 Ln 351, Col 51 CAP NUM File with extension <model name>.sup contains spreadsheets with loads on spring hangers and

and search command (Ctrl-F), it is easy to find instances, when the Code equations are not satisfied.

supports. In order open this file, press emerge (menu "Analysis" - "View Support Loads"):

Model.su	p - WorkPad		-	-		-			x
<u>F</u> ile <u>E</u> dit	<u>V</u> iew <u>H</u> elp								
		Pipin	g Flexibi	lity and	Stress Ana	lysis, d	PIPE		
Version: Date: Company:	5. 2. 14. 6. "CV5"	6 (Build: О 2018	9 Jun 201	8)					Ш
	R ~	ESULTS	5 U M M	ARY	TABLES				
Code:	EN 1348	0-3 (2012)							
Model: Analysis:	: Spring	Design + HTe	st. Stres	s Analys	is (#1)				
>>> Load	d Summary T	able for Anc	hors and	Fix Supp	orts				
Sup ID (node)	Section	FX (fo	FY rce, kN)-	FZ	MX (mome	MY nts, kN*	мZ m)	Mode	
10	P250	-23.8 -0.0 -0.0	60.8 0.0 0.0	-2.9 -5.3 -5.6	-0.8 5.2 5.4	-4.6 0.5 0.5	-69.9 -0.0 -0.0	LS008 LS009 LS010	
70	P250	22.3 0.0 0.0	-64.0 -0.0 -0.0	-9.7 -4.9 -5.1	-12.4 -4.4 -4.6	-5.9 -0.4 -0.5	-58.6 0.0 0.0	LS008 LS009 LS010	
Notes:									
L5008 L5009 L5010	- - -	Hot Loads Cold Loads Hydro Test	Loads						
1									
						L	.n 37, Col 30	CAP NU	M .a

2.7.2 Pipe3DV

Pipe3DV is a browser for the dPIPE models and analysis results. To launch PIPE3DV use button, as result a window with the analyzed model will be opened:



The left toolbar is used to switch on/off the different symbols on the picture: piping supports,

nodal data, etc. The button is utilized to turn on/off the picture from 1D to 3D mode. Picture's scaling may be accomplished with numpad keys "+/-". The model may be moved or rotated either by the mouse or with arrows keys (use CTRL to change the mode from the moving to the rotation).

The buttons *and* are used for the visualization of the stresses and piping deflections respectively. Results of analyses may be accessed also from the menu Results/Table (or use CTRL-R shortcut):

element ():

Sesults viewer						×
Stress (MPa)		Displac	ements (mm,	deg)		
SGM1	Elements	Node 1	Node 2	S begin	S middle	S en
SGM1T (HTEST)	Pipe	10	20	246.4	73.3	269.
! SGM3	Pipe	20	30	269.9	304.0	337.
I SGM4	Bend	30	40	337.9	287.0	105.
	Pipe	40	90	105.2	63.8	85
	Bend	90	60	85.4	266.0	316
	Pipe	60	62	316.1	283.6	253
	Pipe	62	tee_1	253.1	227.8	202
	Pipe	tee_1	70	202.9	63.5	192
	Ove	erstress	ed eler	ments	are	
	011				aro	
		highlig	hted b	y red		
Show only the elements in excess of the allowable stress						
Show elements for which the threshold is exceeded near of allowable stresses						
Offset model when element is selected in the list						
Show selection only	<					Þ
SGM4						

Mouse's context menu provides an access to the results associated with node (

E Eile											
- THE	Edit Mo	des Results	Text View	Tools Help	o						
		i 🛗 🗟		ן נ		<u></u>		-			
		Zoom model Rotate mode Move model Node Info Element Info Select Go to Table - Distance Dimensions Text On 3D View View Labels View Points	Ctrl+1 Shift	F10 +N :+P	× 1 00	20					
s P Informa	ation on the	Legend settin	ngs	1. Displaceme	ents and stree	sses ▼hi = !	50 Th	ieta = 30 🔡			
Information V	ation on the Vindow Lab	Legend setti node of mode	ngs	1. Displaceme	ents and stree	sses ▼ hi = !	50 Th	eta = 30			×
Information V	Vindow Lab	Legend setti node of mode el of node X 3863.70	ngs	1. Displaceme . Displacement . 00 –10	Z 135.28	sses ▼ hi = !	50 Th	eta = 30			×
Information V rdinates	Vindow Lab node : Hydro T Extra	Legend setti node of mode el of node 3863.70 eight def l hermal exp est Displa Data :	a: 62 -9400 ections: comments:	1. Displaceme .00 -10 .00 -10 .00 -10 .01 .01 .01	2 35.28 4¥ -0.00 14.01 -0.00	sses ▼ hi = 5 dZ -0.00 -0.00	50 Th	ieta = 30			×
Information W rdinates	Vindow Lab node : Hydro T Extra	Legend setti node of mode el of node X 3863.70 eight defl hermal exp est Displa Data :	ngs a : 62 y -9400 ections: comments: ,	1. Displaceme .00 -10 .00 -10 .01 9.05 -0.01	ents and stree 35.28 d¥ -0.00 14.01 -0.00	dZ −0.00 −0.00	50 Th	ieta = 30			
Information V rdinates liding Node: Support	Vindow Lab node : Hydro T Extra t slidin	el of node 3863.70 eight defl hermal exp est Displa Data :	e : 62 y -9400 ections: comments: , 62	1. Displaceme 0.00 -10 -0.01 9.05 -0.01	ents and stree 35.28 d¥ −0.00 14.01 −0.00	sses ▼ hi = ! dZ -0.00 -0.00 -0.00	50 Th	reta = 30			
formation V rdinates liding Node: Suppor-	Vindow Lab node : Hydro T Extra Extra	el of node 3863.70 eight defl hermal exp est Displa Data :	a : 62 -9400 ections: comments: , 62 Fx	1. Displaceme 0.00 -10 -0.01 9.05 -0.01 9.05 -0.01	ents and stree 135.28 dY -0.00 14.01 -0.00 Fz	dZ −0.00 −0.00 −0.00	50 Th	eta = 30	Dz	<5>	E
Information V Information V In	Vindow Lab node : Hydro T Extra Extra t slidin	Legend setti node of mode el of node X 3863.70 eight defl hermal exp est Displa Data :	ngs a : 62 -9400 ections: comments: , 62 Fx 3244 0 0	1. Displaceme 1. Displaceme 1. Displacement 1. Displacement 2. 00 -10 2. 00 -10 3. 00 9. 05 -0. 01 9. 05 -0. 01 0 0 0 0 0 0 0 0 0 0 0 0 0	ents and stres	sses ▼ hi = 5 dZ −0.00 −0.00 −0.00 FRIC 5985 0 0	Dx (mi 9.04 -0.01	Dy .111imeter) 14.01 -0.00 -0.00	Dz -0.00 -0.00 -0.00		E
nformation V rdinates liding Node: Suppor- bal: Hot Loads Cold Loads	Vindow Lab node : Hydro T Extra Extra t slidin	Legend setti node of mode el of node 3863.70 eight defl hermal exp est Displa Data :	a : 62 -9400 ections: pansions: 62 Fx 3244 0 0	1. Displaceme .00 -10 .00 -10 .01 9.05 -0.01 9.05 -0.01 .00 .00 .00 .00 .00 .00 .00	ents and stres	sses ▼ hi = 5 dZ -0.00 -0.00 -0.00 -0.00 5985 0 0	50 Th	.11imeter) 14.01 -0.00 -0.00	Dz -0.00 -0.00 -0.00	< <u></u>	

Other PIPE3DV options: measuring of the distances between nodes (button), dimensioning (), selection and showing of the different parts of the model basing on some features (piping

(1), selection and showing of the different parts of the model basing on some features (piping materials, sections, logical names, etc.).

Pipe3DV is freeware, it does not require special installation, it may be used by the Users for the exchange of results with third parties, just sending file <model.bin> and giving the reference on <u>PIPE3DV</u>...