

# CoCoViLa educational applications (mech. eng., civil eng. etc.) & How easy is it to get started?

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## Content

- How easy is it to get started? Installation
- Course: IAG0410 Basics of CAD & CoCoViLa
- Package Gearbox
- Package Shafts
- Packages in civil engineering
- Educational packages
- Simple package development technology in CoCoViLa

How easy is it to get started?

## **Installation**

- WebStart
  - Java 8. 60
  - Delete old Java components
  - Java security
  - command line
  
- Download
  - se
  - ce
  - shortcuts

Course: IAG0410 Basics of CAD

Today it Includes ExpertPRIZ and NUT exercises  
and CoCoViLa demonstrations

Geometry

Physics

+

new exercise in CoCoViLa

Gearbox (mech. eng)

- ce. se, ports, ...

# Composing scheme and computing

Load package

Create elements

Link elements via ports

Input initial values

Draw specification (scheme)

Synthesize computing program (Compute All)

Perform calculations

Propagate values

The image shows the COCOVILA - Scheme Editor interface. The main window displays a schematic diagram of a gear train. A green motor block is connected to a blue selector block, which is connected to a series of grey gear shafts. A menu is open over the 'gearbox' element, showing options like 'Specification...', 'Run', 'Run & Propagate', 'Gearbox.meth', 'Gearbox.spec', and 'Options...'. Several dialog boxes are open, each for a different component:

- Wheel\_0**: Object name Wheel\_0 (String), z (int), D 60 (int), F (double), v (double), T (double), n (double), m (double).
- Wheel\_1**: Object name Wheel\_1 (String), z (int), D 70 (int), F (double), v (double), T (double), n (double), m (double).
- Wheel\_3**: Object name Wheel\_3 (String), z (int), D 140 (int), F (double), v (double), T (double), n (double), m (double).
- Motor\_4**: Object name Motor\_4 (String), P (double), n (double), T (double).
- Table\_5**: Object name Table\_5 (String), first 100 (int), step 100 (int), last 1000 (int).
- Wheel\_2**: Object name Wheel\_2 (String), z (int), D 100 (int), F (double), v (double), T (double), n (double), m (double).
- Selector\_6**: Object name Selector\_6 (String).

# Specification

# Program

```
Specification
Specification Program Run results
Compute goal Compute all

public class Gearbox {
  /*@ specification Gearbox {
    Wheel Wheel_0;
      Wheel_0.D = 60;
    Wheel Wheel_1;
      Wheel_1.D = 70;
    Wheel Wheel_2;
      Wheel_2.D = 100;
    Wheel Wheel_3;
      Wheel_3.D = 140;
    Motor Motor_4;
    Table Table_5;
      Table_5.first = 100;
      Table_5.step = 100;
      Table_5.last = 1000;
    Selector Selector_6;
    Wheel_0.tang = Wheel_1.tang;
    Wheel_1.axial = Wheel_2.axial;
    Wheel_2.tang = Wheel_3.tang;
    Wheel_0.axial = Motor_4.axial;
    Wheel_3.axial = Selector_6.pair;
    Selector_6.snd = Table_5.y;
  }@*/
}
```

```
Specification
Specification Program Run results
Compile & Run

public class Gearbox implements
IComputable {

  public Wheel Wheel_0 = new Wheel();
  public Wheel Wheel_1 = new Wheel();
  public Wheel Wheel_2 = new Wheel();
  public Wheel Wheel_3 = new Wheel();
  public Motor Motor_4 = new Motor();
  public Table Table_5 = new Table();
  public Selector Selector_6 = new
Selector();
  public void compute( Object...
args ) {

    Wheel_2.D= (int)( 100 );
    Wheel_0.D= (int)( 60 );
    Table_5.last= (int)( 1000

);

    Table_5.step= (int)( 100 );
    Wheel_1.D= (int)( 70 );
    Wheel_3.D= (int)( 140 );
    Table_5.first= (int)( 100

);
}
}
```

## Result

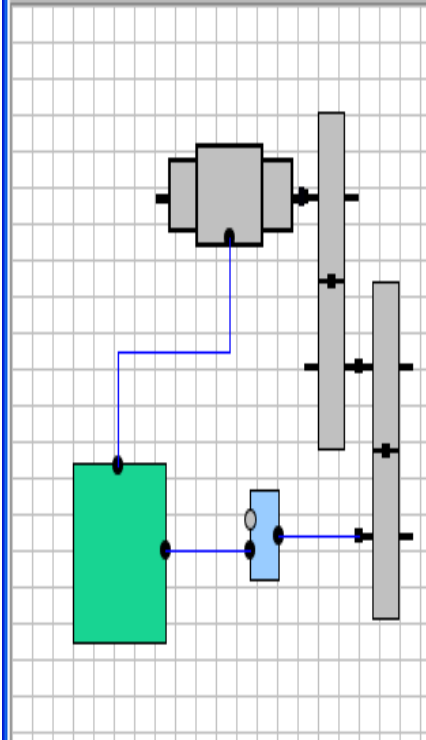
```
Result table
```

100.0	200.0	300.0	400.0	500.0	600.0	700.0	800.0	900.0
1.6333...	3.2666...	4.9	6.5333...	8.1666...	9.8	11.433...	13.066...	14.7
0.8166...	1.6333...	2.45	3.2666...	4.0833...	4.9	5.7166...	6.5333...	7.35
0.5444...	1.0888...	1.6333...	2.1777...	2.7222...	3.2666...	3.8111...	4.3555...	4.9
0.4083...	0.8166...	1.225	1.6333...	2.0416...	2.45	2.8583...	3.2666...	3.675
0.3266...	0.6533...	0.98	1.3066...	1.6333...	1.96	2.2866...	2.6133...	2.94
0.2722...	0.5444...	0.8166...	1.0888...	1.3611...	1.6333...	1.9055...	2.1777...	2.45
0.2333...	0.4666...	0.6999...	0.9333...	1.1666...	1.3999...	1.6333...	1.8666...	2.1000...
0.2041...	0.4083...	0.6125	0.8166...	1.0208...	1.225	1.4291...	1.6333...	1.8375
0.1814...	0.3629...	0.5444...	0.7259...	0.9074...	1.0888...	1.2703...	1.4518...	1.6333...

# COCOVILA - Scheme Editor

File Edit Package Scheme Options Help

gearbox



### Wheel\_0

Object name	Wheel_0	(String)
z		(int)
D	60	(int)
F	33.333333333333336	(double)
v	169.56	(double)
T	1.0	(double)
n	900.0	(double)
m		(double)

OK Clear all

### Wheel\_1

Object name	Wheel_1	(String)
z		(int)
D	70	(int)
F	33.333333333333336	(double)
v	169.56	(double)
T	1.1666666666666667	(double)
n	771.4285714285713	(double)
m		(double)

OK Clear all

### Wheel\_2

Object name	Wheel_2	(String)
z		(int)
D	100	(int)
F	23.333333333333336	(double)
v	242.22857142857143	(double)
T	1.1666666666666667	(double)
n	771.4285714285713	(double)
m		(double)

OK Clear all

### Wheel\_3

Object name	Wheel_3	(String)
z		(int)
D	140	(int)
F	23.333333333333336	(double)
v	242.22857142857143	(double)
T	1.6333333333333335	(double)
n	551.0204081632653	(double)
m		(double)

OK Clear all

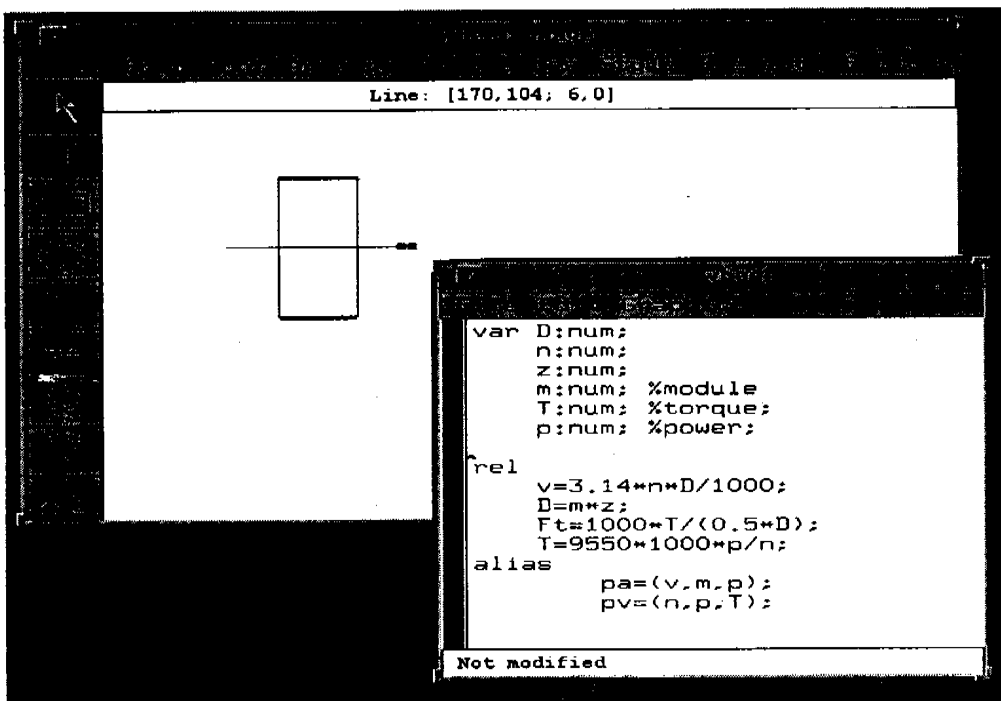
### Motor\_4

Object name	Motor_4	(String)
P	900.0	(double)
n	900.0	(double)
T	1.0	(double)

350, 2

OK Clear all

## GEARS & TRANSMISSIONS



The image shows a software interface with a dark background. At the top, a status bar displays "Line: [170,104; 6,0]". Below this, a white rectangular area contains a simple diagram of a gear, represented by a vertical rectangle with a horizontal line passing through its center. To the right of this area is a code editor window with a white background, containing the following text:

```
var D:num;  
n:num;  
z:num;  
m:num; %module  
T:num; %torque;  
p:num; %power;  
  
rel  
v=3.14*n*D/1000;  
D=m*z;  
Ft=1000*T/(0.5*D);  
T=9550*1000*p/n;  
  
alias  
pa=(v,m,p);  
pv=(n,p,T);
```

At the bottom of the code editor window, the text "Not modified" is visible.

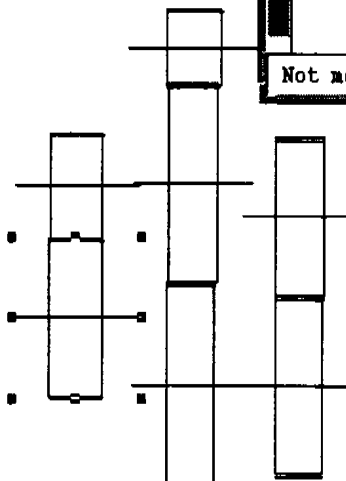


```
wheel  
wheels  
wheels2  
wpor  
wporh
```

```
% scheme begin  
var  
wheel19: wheel D=66;  
wheel18: wheel D=90,m=3;  
wheel17: wheel D=105;  
wheel16: wheel D=36;  
wheel15: wheel D=120,m=3;  
wheel14: wheel D=75,m=5;  
wheel13: wheel D=100,n=300,p=2;  
rel  
wheel19.pa = wheel18.pa ;  
wheel18.pv = wheel17.pv ;  
wheel17.pa = wheel15.pa ;  
wheel16.pa = wheel15.pa ;  
wheel15.pv = wheel14.pv ;  
wheel14.pa = wheel13.pa ;
```

wheel13: [97,

Not modified



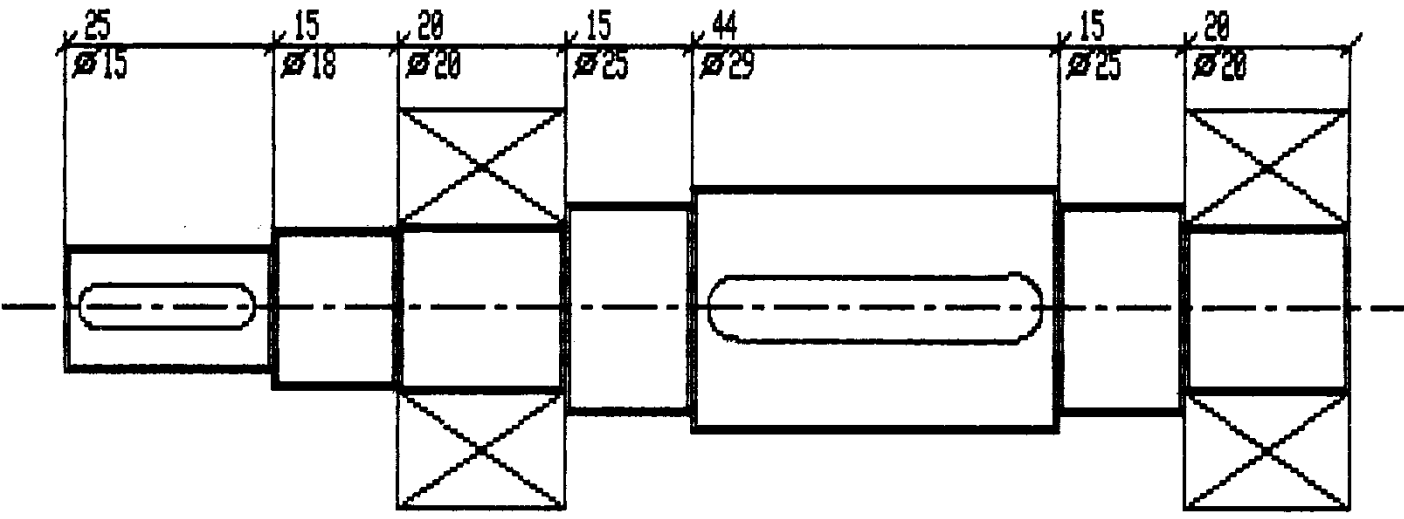
```
wheel13: [97,  
file locations  
wheel :  
* 1 D = 100  
* 2 n = 300  
3 z = 20  
4 m = 5  
5 T = 63666.7  
* 6 p = 1  
7 v = 94.2  
8 Ft = 1.27333e+06
```

ALGORITHM 1

```
(wheels) ->
wheel19(wheel).8882 :->z
wheel18(wheel).8882 :->z
wheel17(wheel).8882 :->z
wheel16(wheel).8882 :->z
wheel15(wheel).8882 :->z
wheel14(wheel).8882 :->z
wheel13(wheel).8881 :->v
wheel13(wheel).8882 :->z
wheel13(wheel).8884 :->T
wheel13(wheel).8885 :->pa
wheel13(wheel).8886 :->pv
wheel13(wheel).8883 :->Ft
wheel14(wheel).8885 :->v,m,p
wheel14(wheel).8881 :->n
wheel14(wheel).8884 :->T
wheel14(wheel).8886 :->pv
wheel14(wheel).8883 :->Ft
wheel15(wheel).8886 :->n,p,T
wheel15(wheel).8881 :->v
wheel15(wheel).8883 :->Ft
wheel15(wheel).8885 :->pa
wheel17(wheel).8885 :->v,m,p
wheel17(wheel).8881 :->n
wheel17(wheel).8884 :->T
wheel17(wheel).8886 :->pv
wheel17(wheel).8883 :->Ft
wheel16(wheel).8885 :->v,m,p
wheel16(wheel).8881 :->n
wheel16(wheel).8884 :->T
wheel16(wheel).8886 :->pv
wheel16(wheel).8883 :->Ft
wheel18(wheel).8886 :->n,p,T
wheel18(wheel).8881 :->v
wheel18(wheel).8883 :->Ft
wheel18(wheel).8885 :->pa
wheel19(wheel).8885 :->v,m,p
wheel19(wheel).8881 :->n
wheel19(wheel).8884 :->T
wheel19(wheel).8886 :->pv
wheel19(wheel).8883 :->Ft
END OF ALGORITHM 1 ( 40 ope
```

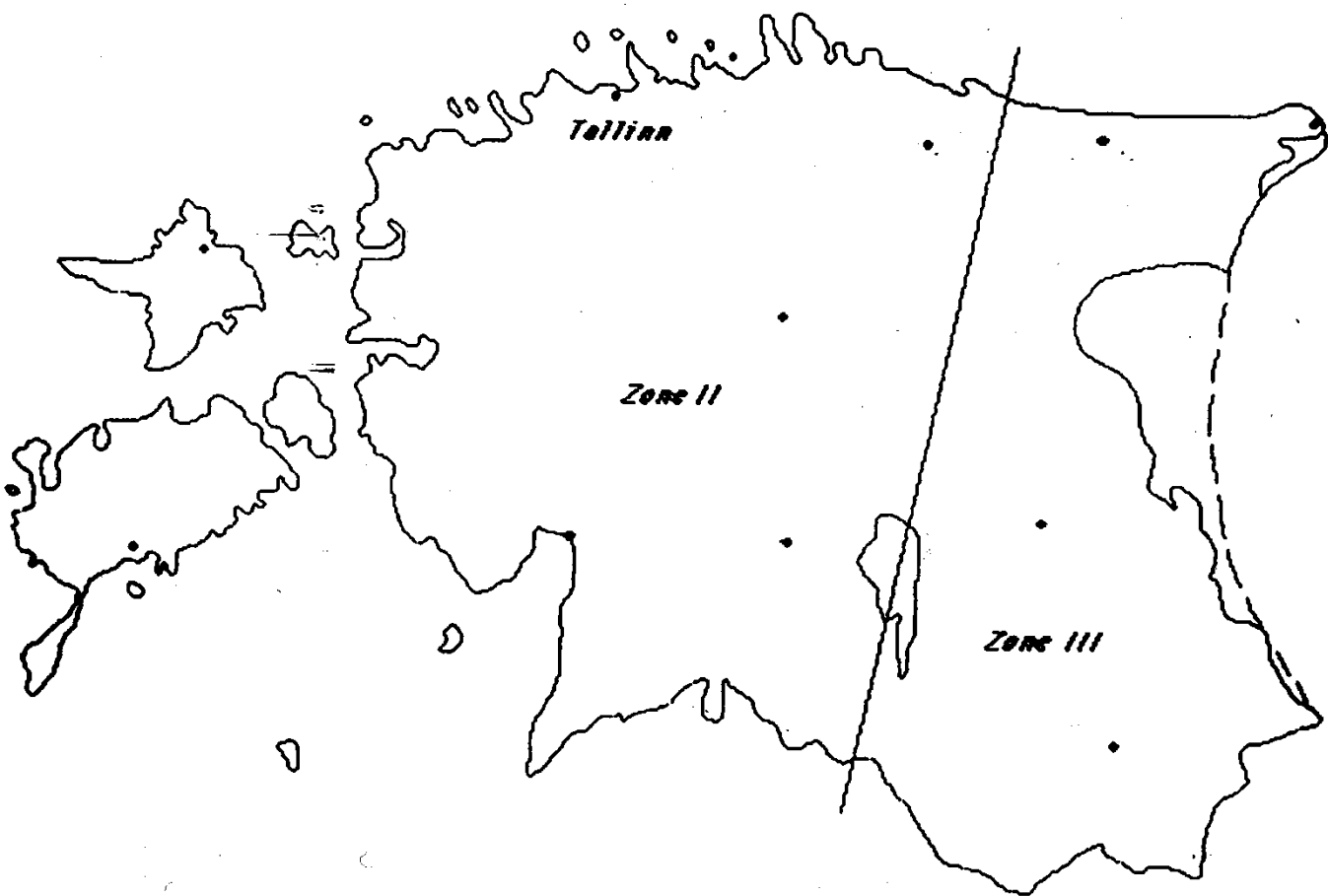
```
wheels :
1 wheel19 = wheel :
1 D = 66
2 n = 623.377
3 z = 22
4 m = 3
5 T = 30639.6
6 p = 2
7 v = 129.189
8 Ft = 928472
2 wheel18 = wheel :
1 D = 90
2 n = 457.143
3 z = 30
4 m = 3
5 T = 41781.2
6 p = 2
7 v = 129.189
8 Ft = 928472
3 wheel17 = wheel :
1 D = 105
2 n = 457.143
3 z = 35
4 m = 3
5 T = 41781.2
6 p = 2
7 v = 150.72
8 Ft = 795833
4 wheel16 = wheel :
1 D = 36
2 n = 1333.33
3 z = 12
4 m = 3
5 T = 14325
6 p = 2
7 v = 150.72
8 Ft = 795833
5 wheel15 = wheel :
1 D = 120
2 n = 400
3 z = 40
4 m = 3
5 T = 47750
6 p = 2
7 v = 150.72
8 Ft = 795833
6 wheel14 = wheel :
1 D = 75
2 n = 400
3 z = 15
4 m = 5
5 T = 47750
6 p = 2
7 v = 94.2
```

# Shafts

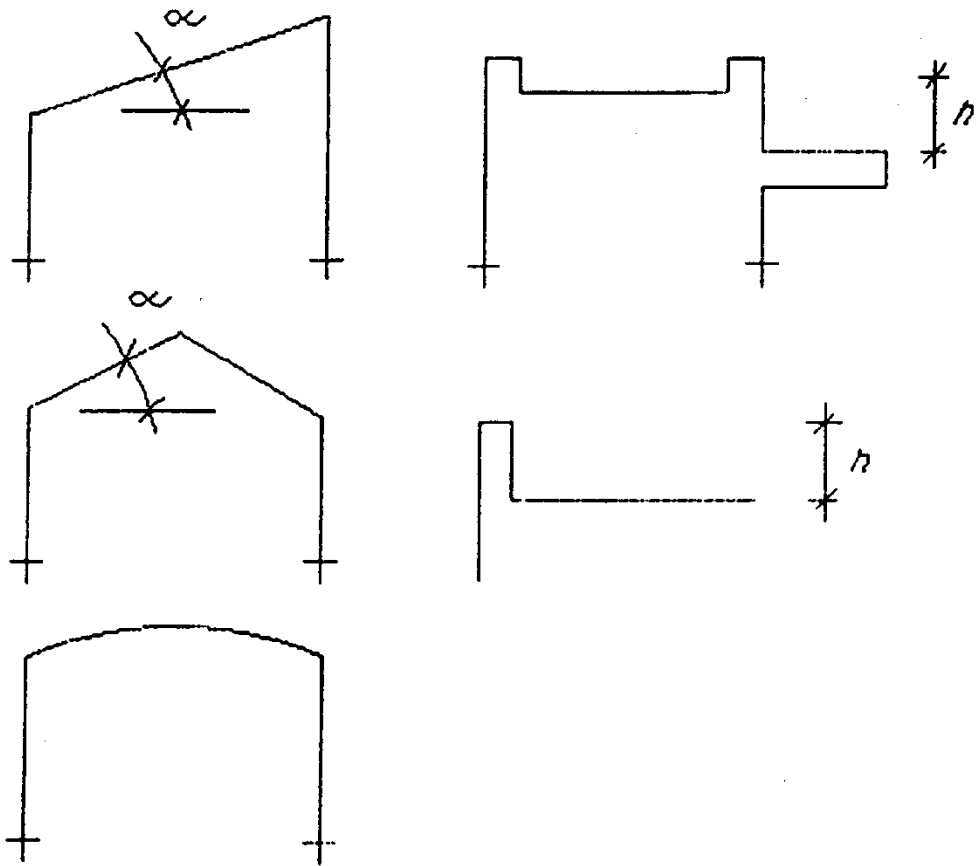


## Civil engineering

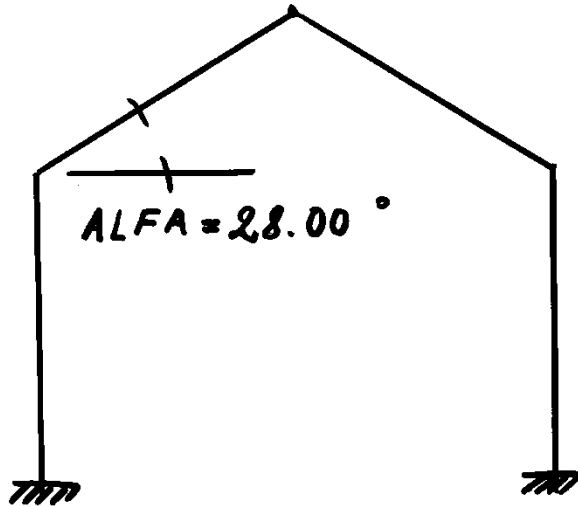
- Snow load
- Wind load
- ....



*Figure 2. Estonian snowcover*



*Figure 3. Shapes of roofs*



-  $S = 0.700 \text{ kPa}$   
 $S_a = 1.000 \text{ kPa}$

$S_1 = 0.490 \text{ kPa}$   
 $S_{a1} = 0.700 \text{ kPa}$



-  $S_2 = 0.910 \text{ kPa}$   
 $S_{a2} = 1.300 \text{ kPa}$



TYPES OF THE ROOF

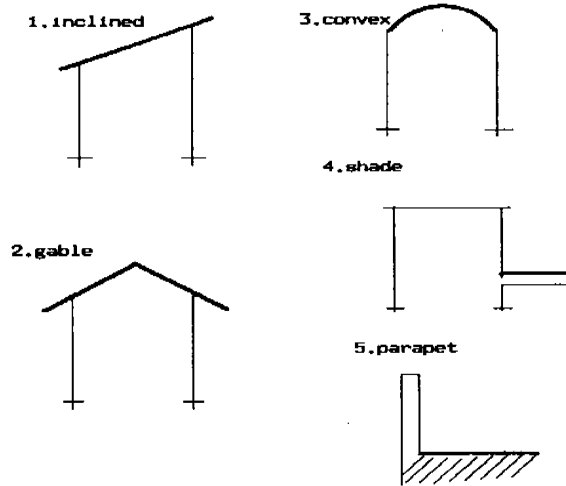


Figure 3

ROOF WEIGHT AND SNOW WEIGHT RATIO

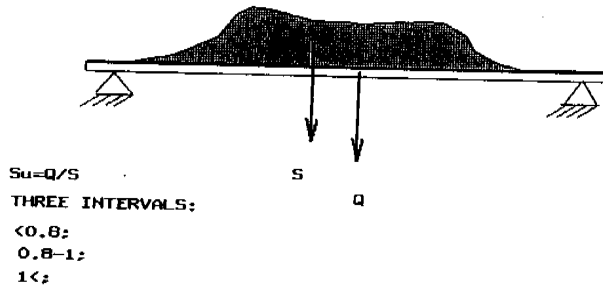


Figure 4

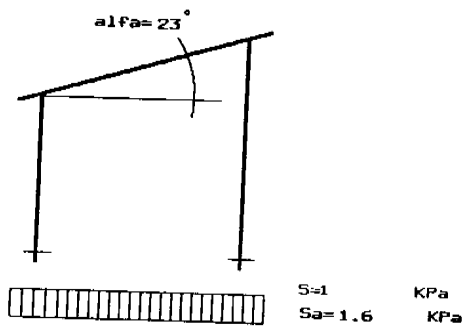
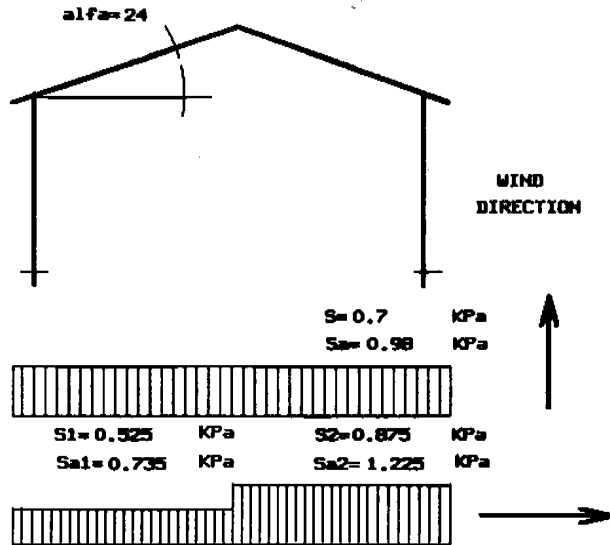


Figure 5

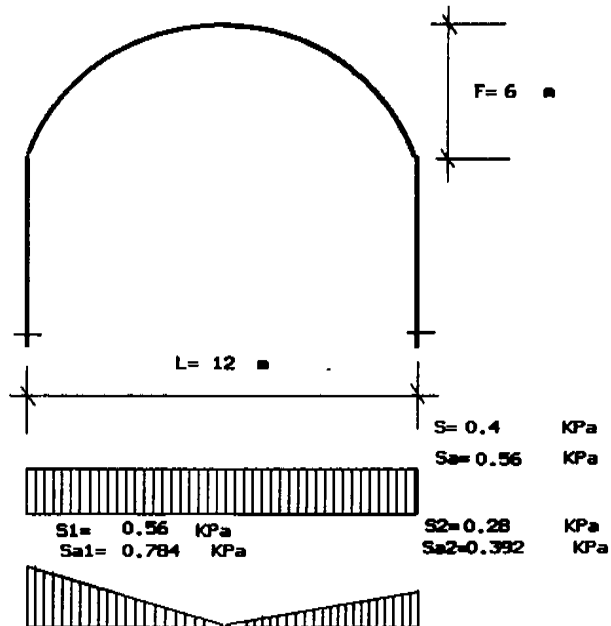
## 5. Appendix I

The results of the calculations for the different types of roofs

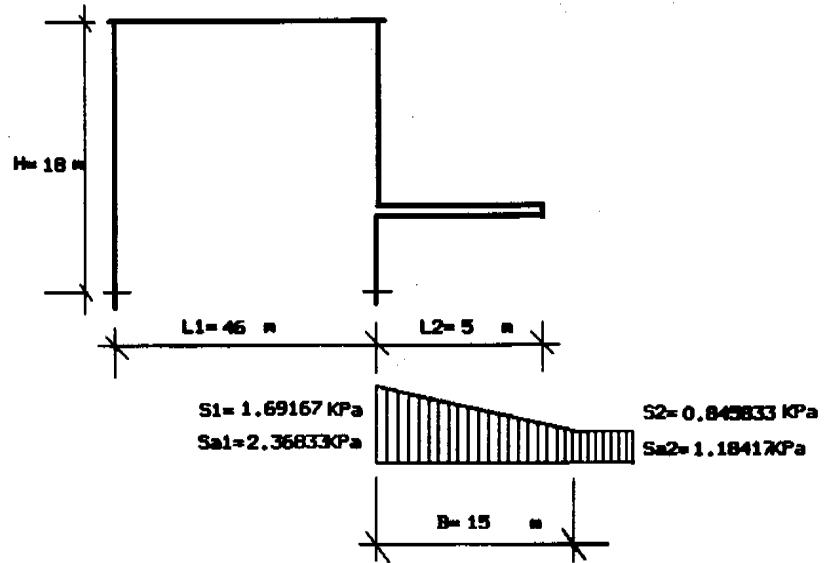
### 5.1 - gable



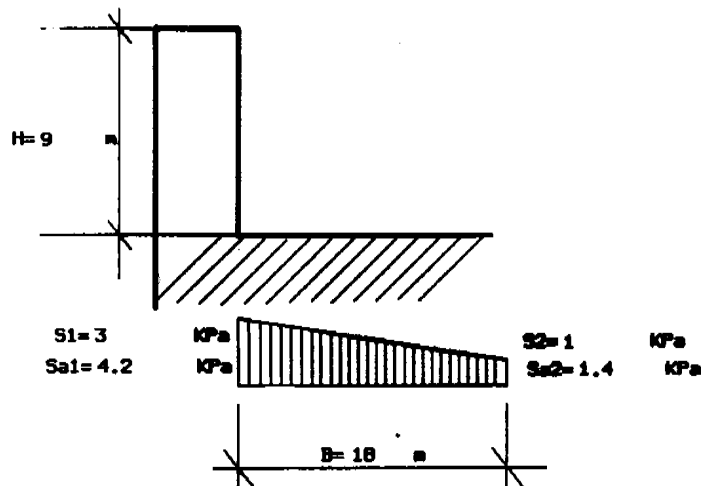
### 5.2 - convex



### 5.3 - shade



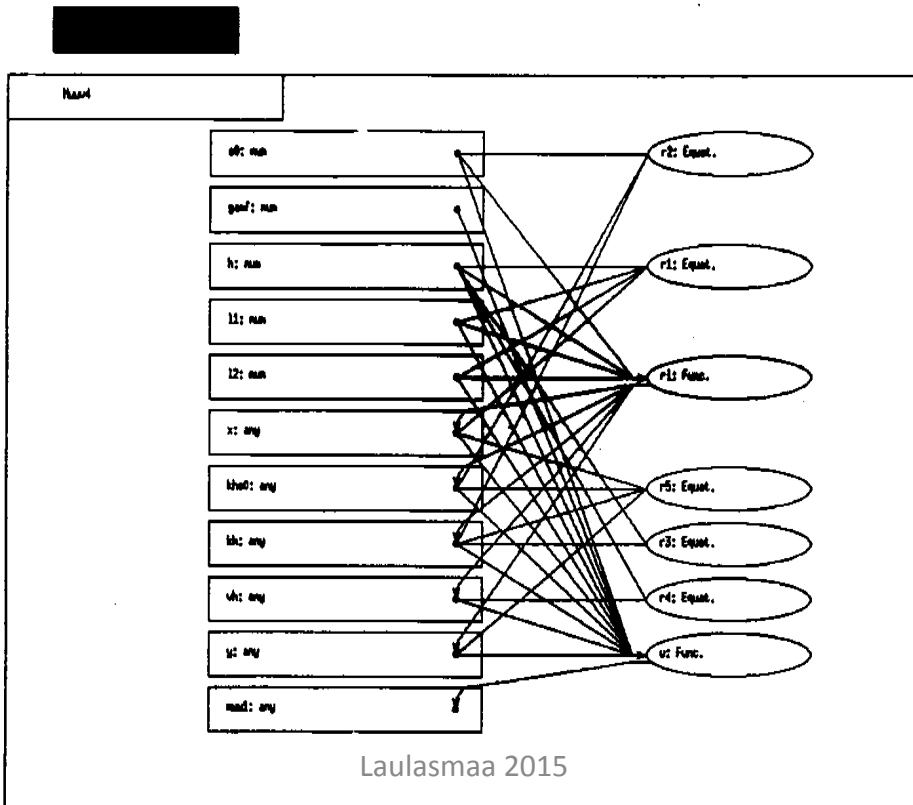
### 5.4 - parapet



```

_Muuv4
var s0,gamf,h,l1,l2:num;
% *** find the control parameters ***
rel r1:x=1+0.5*(l1+l2)/h;
r2:khs0=kh/s0;
r3:kh=2*h;
r4:vh=5*h;
r5:y=(x-1)+kh/(khs0-1);
r1:s0,h,l1,l2->x,khs0,kh,vh,y(spec);
u:s0,gamf,h,l1,l2,x,khs0,kh,vh,y->muul{
% *** find muul and final results ***
lab1:if
(x<=6)&(x<=khs0)->muul:=x;
en:=new Bend s0:=s0,gamf:=gamf,muul:=muul,
h:=h,l1:=l1,l2:=l2,kh:=kh;
en.w();
|| (x<=6)&(x>khs0)->muul:=khs0;
en2:=new Bend2 s0:=s0,gamf:=gamf,muul:=muul,
h:=h,l1:=l1,l2:=l2,y:=y,vh:=vh;
en2.w();
|| (x>6)&(x<=khs0)->muul:=6;
en:=new Bend s0:=s0,gamf:=gamf,muul:=muul,
h:=h,l1:=l1,l2:=l2,kh:=kh;
en.w();
|| (x>6)&(x>khs0)->
mu:=new Muuv4a khs0:=khs0;
mu.u();
en2:=new Bend2 s0:=s0,gamf:=gamf,muul:=mu.muul,
h:=h,l1:=l1,l2:=l2,y:=y,vh:=vh;
en2.w();
fi;
};

```



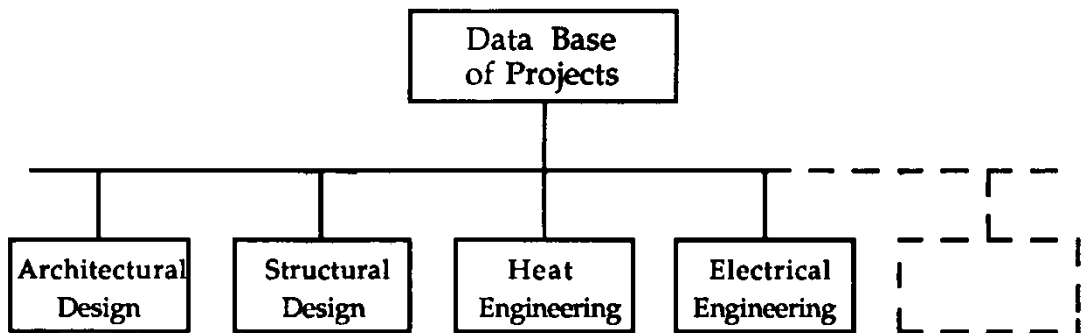


Figure 5. The components of CAD in civil engineering

Educational packages:

- CoCoViLa homepage
- Mait's presentations
- Ahto's supervised master thesis :

U. Lipso. Rihmülekannete projekteerimispakett tarkvarasüsteemi VSLE testimiseks. (MSc thesis, 2004)

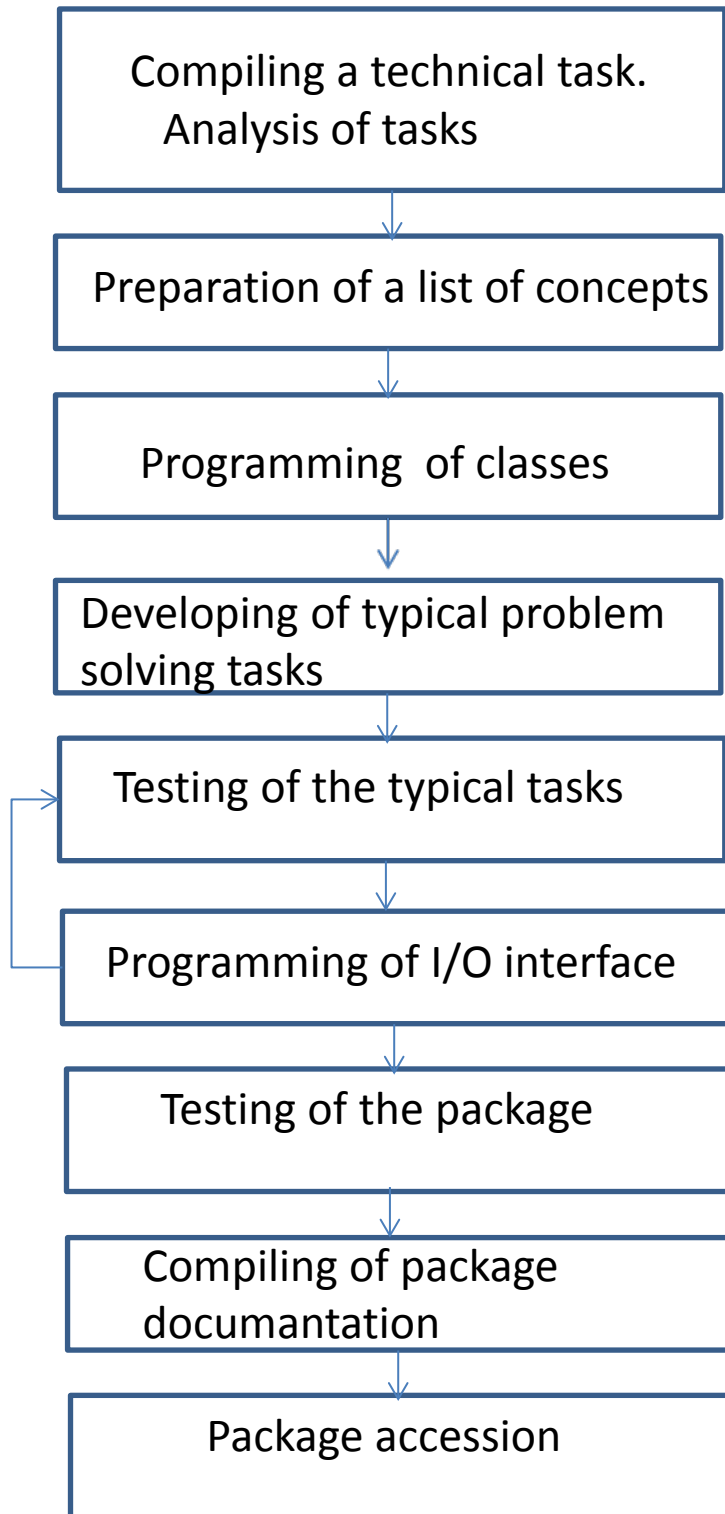
T. Matsalu. Program package for designing chain conveyor in CoCoViLa software system. (MSc thesis, 2007)

M. Viil. Program package for designing gear drive in CoCoViLa software system. (MSc thesis, 2008)

# Creating software packages. Stages

1. Compiling a technical task.  
Analysis of tasks
2. Preparation of a list of concepts
3. Programming of concepts
4. Developing of typical problem solving tasks
5. Programming of input-output interface
6. Testing the typical tasks
7. Testing of the package
8. Compiling package documentation
9. Package accession

# Creating software packages. Stages





**Thank You!**