



MEPLA

Software for Structural Glass Design



Short Introduction Version 5.0

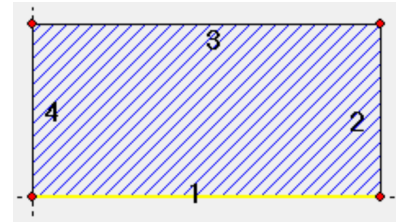
Januar 2020

Geometry

Rectangle

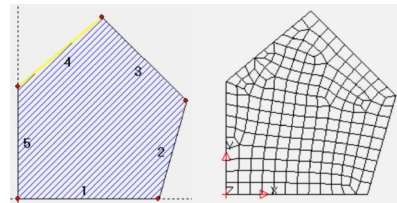
2000x1000mm

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="b"/>	<input type="text" value="0"/>			
1	0	0			
2	2000	0			
3	2000	1000			
4	0	1000			



Pentagon

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="600"/>	<input type="text" value="130b"/>			
1	0	0			
2	1000	0			
3	1200	700			
4	600	1300			
5	0	800			



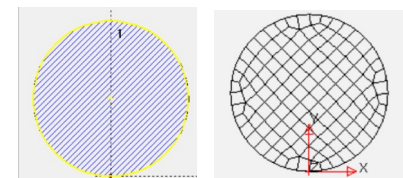
Disk

D1000mm

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="500"/>	<input type="text" value="1"/>
1	0	0	0	500	1

or

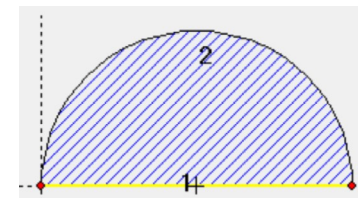
Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="500"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="1"/>
1	500	0	0	0	1



Halfmoon

R500

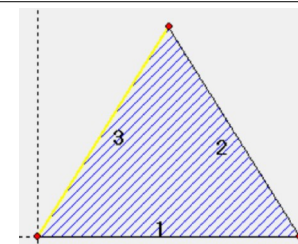
Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="0"/>	<input type="text" value="0"/>			
1	0	0			
2	1000	0	500	0	1



Triangle

B = 1000
H = 800

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="500"/>	<input type="text" value="800"/>			
1	0	0			
2	1000	0			
3	500	800			



Ellipse

R1 = 650
R2 = 400

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	<input type="text" value="650"/>	<input type="text" value="0"/>	<input type="text" value="377.3"/>	<input type="text" value="0"/>	<input type="text" value="1"/>
1	650	0	377.3	0	1
2	627.6	104.1	356.3	-8.7	1
3	560.5	202.5	122.1	-250.9	1
4	337.3	343.4	0	-598.6	1
5	0	400			
6	0	0			

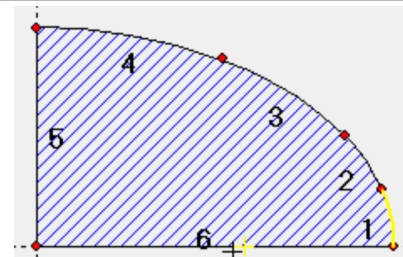
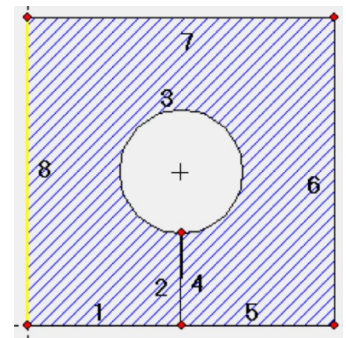


Plate with Hole

1000x 1000mm
Hole D400

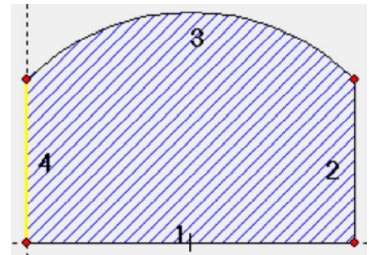
Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	b	1000			
1	0	0			
2	500	0			
3	500	300	500	500	-1
4	500	300			
5	500	0			
6	1000	0			
7	1000	1000			
8	0	1000			



Rectangle with arc

2000x1000m
R 1428mm

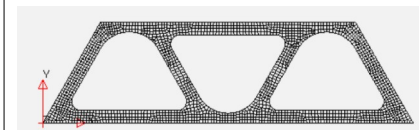
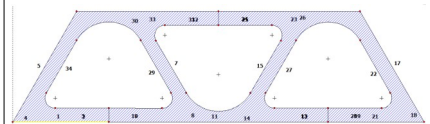
Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	b	1000			
1	0	0			
2	2000	0			
3	2000	1000	1000	0	1
4	0	1000			



Framework

very complex
structures

Edge	X [mm]	Y [mm]	X_m	Y_m	Rotation
	0	0			
1	0	0			
2	606	0			
3	606	87			
4	268	87	268	152	-1
5	212	184			
6	403	516	606	399	-1
7	808	516			
8	1000	184	943	152	-1



...

Layers

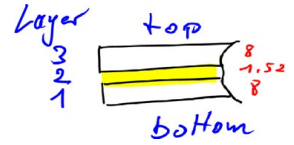
Single glass
1 x 10mm

Layer	Material	E	v	t	ρ	α_T	ΔT
	Float glass	70000	0.23	10	2.55e-9	1.e-5	0
1	Float glass	70000	0.23	10	2.55e-9	1.e-5	0



Laminated glass
8/1.52/8

Layer	Material	E	v	t	ρ	α_T	ΔT
	Float glass	70000	0.23	8	2.55e-9	1.e-5	0
3	Float glass	70000	0.23	8	2.55e-9	1.e-5	0
2	PVB long time loading	0.03	0.5	1.52	1.07e-9	8.e-5	0
1	Float glass	70000	0.23	8	2.55e-9	1.e-5	0



Insulated glass
8 / gap 16 / 8

Glass package 1

Package: 1 from 2 New item Delete item

Layer	Material	E	v	t	ρ	α_T	ΔT
	Float glass	70000	0.23	8	2.55e-9	1.e-5	0
1	Float glass	70000	0.23	8	2.55e-9	1.e-5	0

Glass package 2

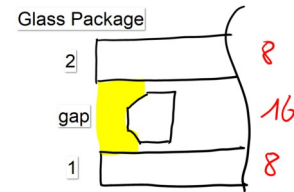
Package: 2 from 2 New item Delete item

Layer	Material	E	v	t	ρ	α_T	ΔT
	Float glass	70000	0.23	8	2.55e-9	1.e-5	0
1	Float glass	70000	0.23	8	2.55e-9	1.e-5	0

Gap 1

Intermediate space:

Package (from-to)	Gas	t	γ	ΔT	P_i
1 - 2	Ideal Gas 20°C (Standard)	16	0.003411	0	0.101
2 - 3				0	0.101
3 - 4				0	0.101



Each glass package can also be any kind of laminated glass!
IGU up to 3 gaps!

Supports

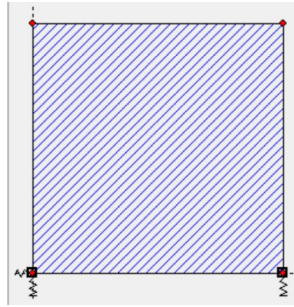
Local Springs

Spring Supports

X [mm]	Y [mm]	C _x	C _y	C _z	C _φ	C _θ
0	0	1	1	0	0	0
0	0	1	1	0	0	0
1000	0	0	1	0	0	0

Default springs:
 Corner 1: C_x = C_y = 1.0 N/mm
 Corner 2: C_y = 1.0 N/mm

Simply to first generate a statically determined system inplane direction using very weak springs!

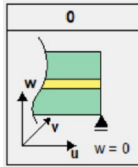


Simply supported

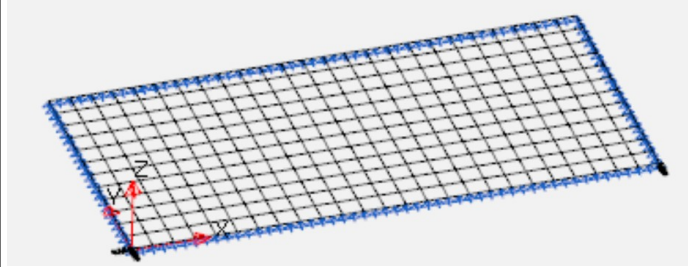
at all edges, nodes fixed to w = 0 mm

Edge Support

Edge	Type
0	0
1	0
2	0
3	0
4	0



simply supported



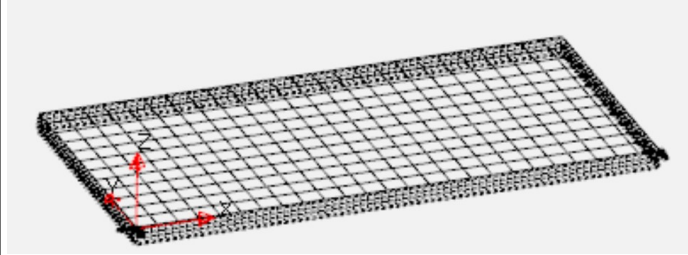
Elastically supported

edges supported on elastic material

Elast. Edge Support

Edge	Contact	E	G	b	h
	<input type="checkbox"/>	10	0	20	5
1		10	0	20	5
2		10	0	20	5
3		10	0	20	5
4		10	0	20	5

slight deflections possible – more real support for glass!

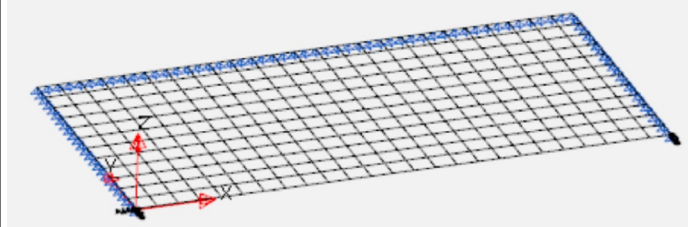


3 side supported

edge 1 free

Edge Support

Edge	Type
1	
2	0
3	0
4	0

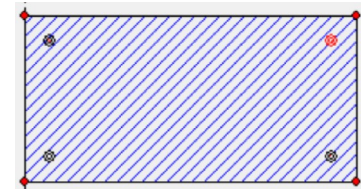


Point supported

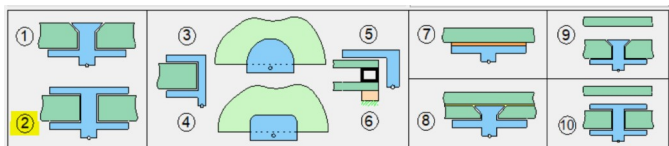
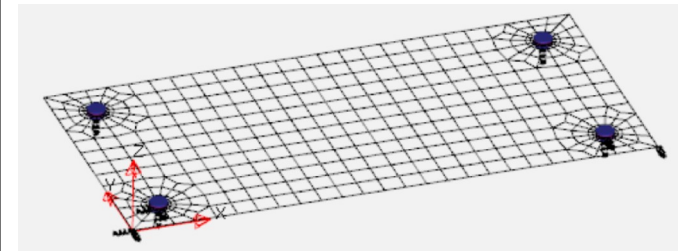
Glass Fixings

Manufacturer - product*	Type	f ₁	f ₂	E _b	E _h	t _b	t _h
DiskFixing	2	18	35	60	500	3	2
DiskFixing	2	18	35	60	500	3	2

*Reference	X [mm]	Y [mm]	Z _b	C _x	C _y	C _z	C _φ	C _θ	Type
DiskFixing	180	850	-10	0	1000	0	0	0	0
DiskFixing	180	150	-10	0	1000	0	0	0	0
DiskFixing	150	850	-10	0	1000	0	0	0	0
DiskFixing	150	150	-10	1000	1000	0	0	0	0



Holes are build automatically
 10 different types possible
 All fixings also for IGUs usable



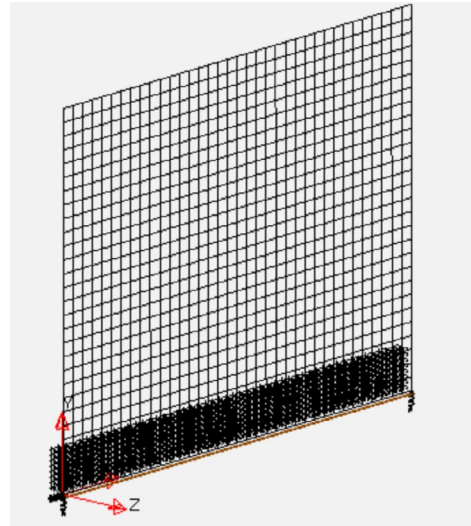
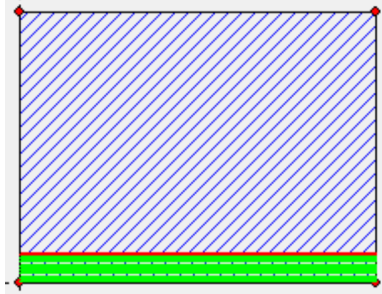
Clamped balustrade

Clamped elastically in a glass shoe



Elast. Line Support

Contact	X ₁	Y ₁	X ₂	Y ₂	E	b	h
	0	150	1840	150	20	20	5
<input type="checkbox"/>	0	130	1840	130	20	20	5
<input type="checkbox"/>	0	110	1840	110	20	20	5
<input type="checkbox"/>	0	90	1840	90	20	20	5
<input type="checkbox"/>	0	70	1840	70	20	20	5
<input type="checkbox"/>	0	50	1840	50	20	20	5
<input type="checkbox"/>	0	30	1840	30	20	20	5
<input type="checkbox"/>	0	10	1840	10	20	20	5

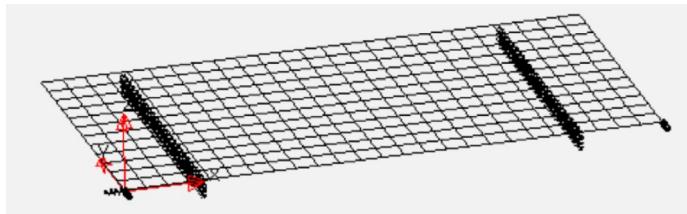


Internally supported

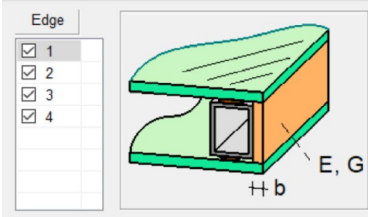
Elastic supports within the glass area

Elast. Line Support

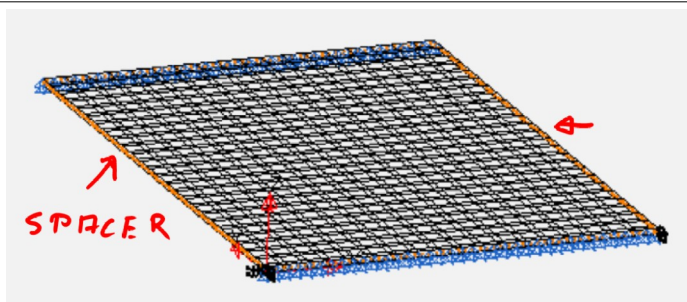
Contact	X ₁	Y ₁	X ₂	Y ₂	E	b	h
	1700	0	1700	1000	20	20	5
<input type="checkbox"/>	1700	0	1700	1000	20	20	5
<input type="checkbox"/>	300	0	300	1000	20	20	5



Spacer



needed to combine glass edges in IGUs to keep edges closed, specially free edges, where no other condition keeps the distance constant



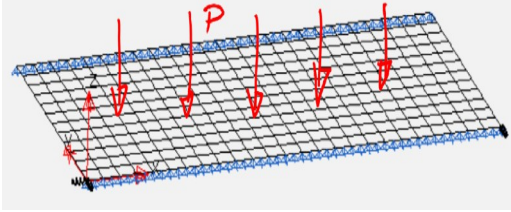
Loads

Face Load

$p = -1.0 \text{ kN/m}^2$
 $= -0.001 \text{ N/mm}^2$
 $= -1.e-3 \text{ N/mm}^2$

constant:
 Package p [N/mm²]
 1 -0.001

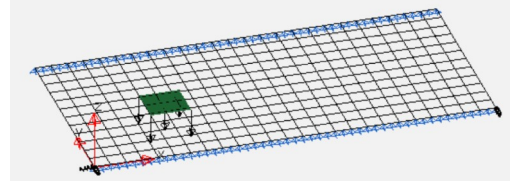
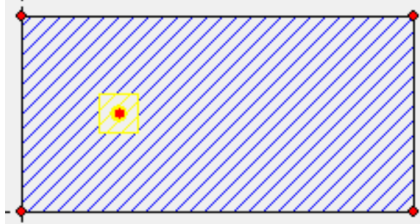
pressure against the z-axis: negative!
 Suction loads in direction of z: positive!



Conc. Load

Center Position,
Load and Area

X [mm]	Y [mm]	F _x [N]	F _y [N]	F _z [N]	L _x [mm]	L _y [mm]
500	500	0	0	-1000	200	200
500	500	0	0	-1000	200	200

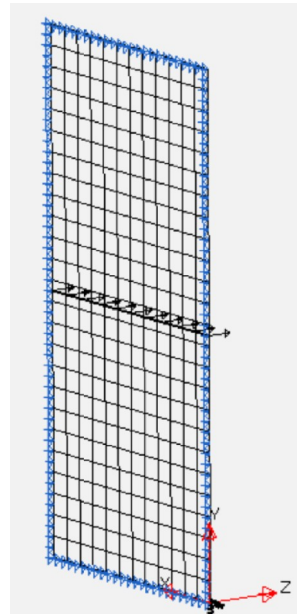
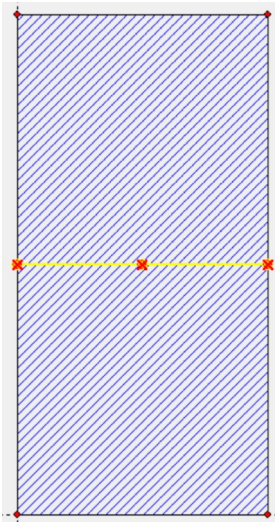


here:
 $F = 1000 \text{ N}$ (in negative z-direction)

Line Load

$q_z = 1 \text{ N/mm}$
 $= 1 \text{ kN/m}$

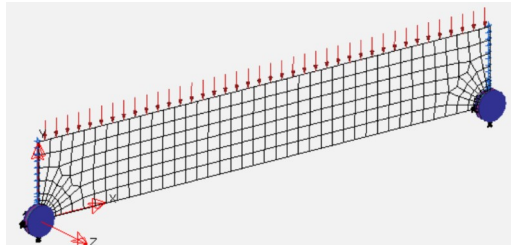
X ₁	Y ₁	X ₂	Y ₂	q _x	q _y	q _z
0	1000	1000	1000	0	0	1
0	1000	1000	1000	0	0	1



Border loads

inplane or out of
 plane edge loads
 $q_n = -1 \text{ N/mm}$
 $= -1 \text{ kN/m}$

Edge	q _z	q _n
1	0	-1
2		
3	0	-1
4		



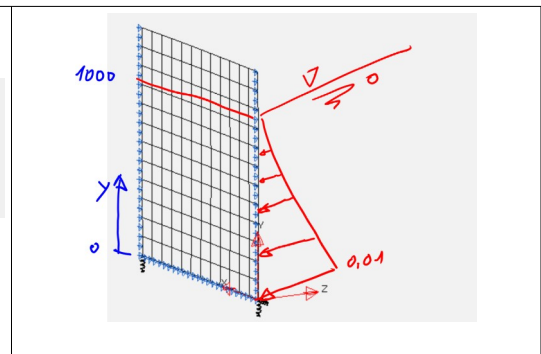
beam, loaded in plane direction

Water Loads

Linear increasing loads

Package	p_0	p_1	y_0	y_1
1	0.01	0	0	1000
2				

Water pressure
 $1m = 0.01 \text{ N/mm}^2$
 $10m = 1 \text{ bar} = 0.1 \text{ N/mm}^2$



Dead load

Dead weight:

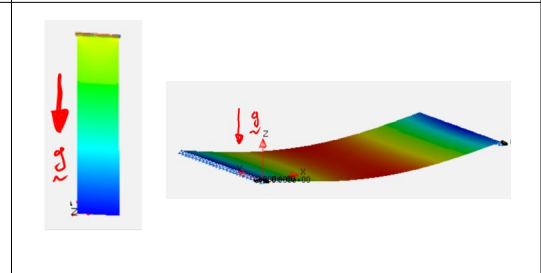
 Use dead weight
 Slope of panel (rotation around x-axis):
 °
 Direction vector of gravity:

Dead weight:

 Use dead weight
 Slope of panel (rotation around x-axis):
 °
 Direction vector of gravity:

vertically horizontally

Volume load in the direction of the gravity vector!
 (any direction possible)



Climate loads

External pressure:
 N/mm^2 Difference of height: m

Climatic load case:
 Summer (default)

- Predefined climate load cases Summer/Winter or any other condition
- Separately or using LoadCases
- Using real Boyle's gas pressure law see also [here](#)



Soft body impact

Dynamic control data:

Impact position (x,y): [mm] [mm]

Drop height: [mm]

Time step length: [s]

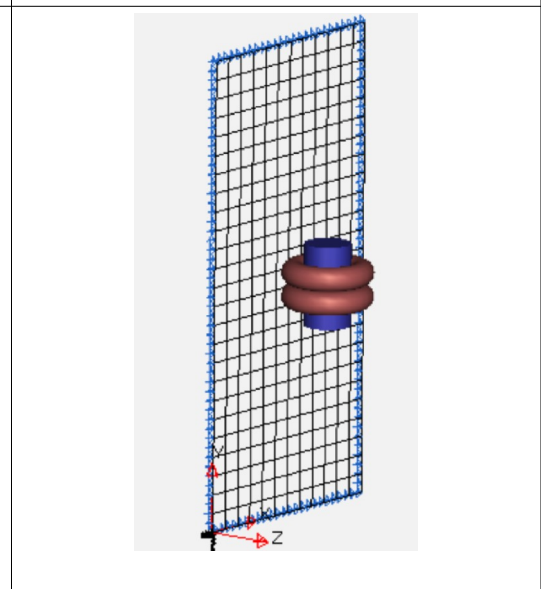
Computing time: [s]

dyn. Analysis

Pendulum Body,
 Wind blast or
 enhanced
 Impact model

x-axis: Time y-axis: Pendulum force

Results over time



Load Cases

Combination of loads according to selected Norms, automated design proof

LC	DW	Wind	Snow	Line	Point	Climate	Shear	Description
1	1	1	1	1	1	1	0	+1.50w(t)+1.E_Foil
2	1	1	1	1	1	1	1	+1.50w(t)+1.05p(t)+1.E_Foil
3	1	1	1	1	1	1	1	+1.50p(t)+1.E_Foil
4	1	1	1	1	1	1	1	+0.90w(t)+1.50p(t)+1.E_Foil

Load cases set up automatically

Loads to be combined automatically incl. line-, point- and climate loads

Wind: Pressure -0.001 Section 0 without 0

Snow: P=0 S=0

Climate: Winter (default) Summer (default) self-defined without

ProofVerification: No proof - only combination Ultimate Limit State ULS Serviceability Limit State SLS

Options

Type of Calculation

Type of Calculation:

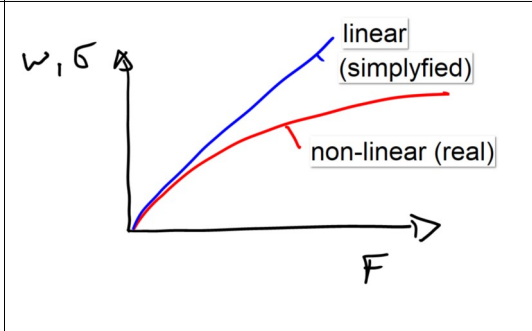
- Single stat. Calculation
- Load Case Calculation
- Pendulum Impact
- Pressure Hit
- Impact Model
- Residual Capacity

Which type of calculation shall be started? One single static calculation, running all loads cases and doing design check or dynamic calculations including mass, time and acceleration effects?

Calculation method

Calculation approach:

- geometrically non-linear
- linear calculation



Additional output points

Local result outputs:

Package: 1 from 1

X [mm]	Y [mm]
500	500
500	500

Analyse distance to package-1

written in *Protocol* and *Diagram* output

Curve diagram

x-axis: Time y-axis: Pendulum, plate displacement

Local displacements and stresses:

Package	x mm	y mm	max mm	min mm			
Layer	σ_{xx} N/mm ²	σ_{yy} N/mm ²	σ_{xy} N/mm ²	σ_{p+} N/mm ²	σ_{p-} N/mm ²		
1	500.00	500.00	4.834	-9.536 (w)	0.000 (u)		
					0.000 (v)		
Maximum	1	18.75	9.68	0.00	18.75	9.68	(top)
	1	36.07	10.79	0.01	36.07	10.79	(bottom)
Minimum	1	-36.07	-10.79	-0.01	-10.79	-36.07	(top)
	1	-18.75	-9.68	-0.00	-9.68	-18.75	(bottom)

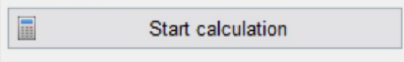
Results

Start Calculation

or

cancel a running calculation

Calculation:



Status of calculation/ system preview:

Status: End of calculation! Computing time: 1.1 [sec]

Progress:

Calculation control:

Type of calculation: Single calculation

Portion of loads [%]: 100.0

Sum of loads [%]: 100.0

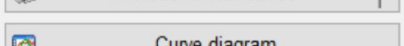
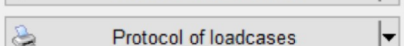
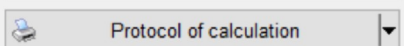
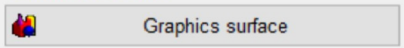
Error [N]: 0.00

Iteration [-]: 2

Calculation results

Graphics
Protocols, Design Proof
Diagram

Calculation results:



SI MEPLA (Project Introduction - Loads - Face)

