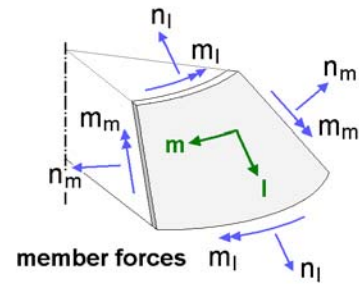
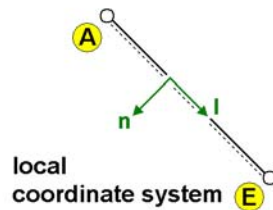
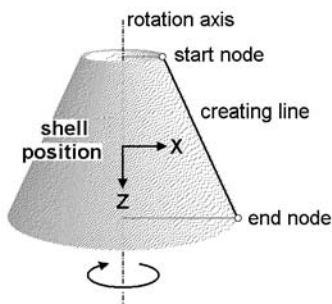


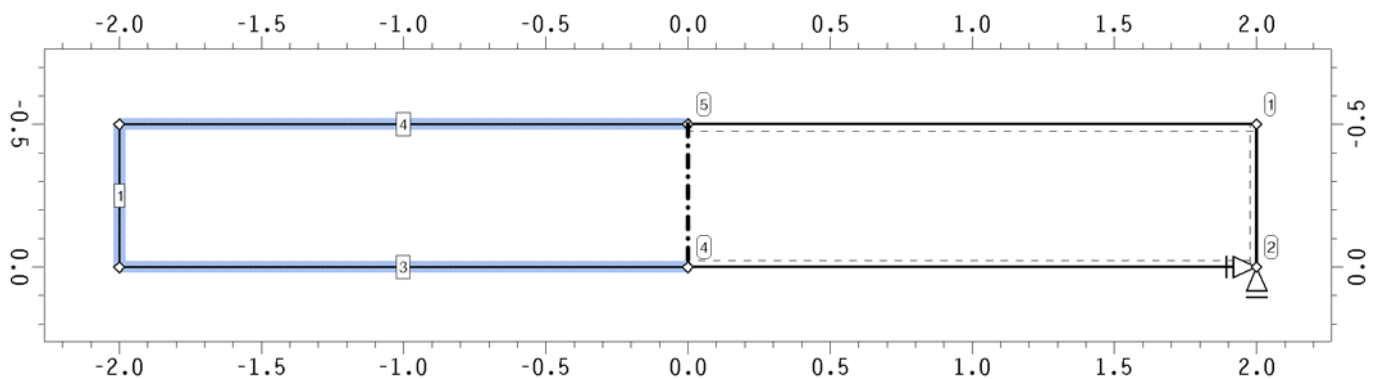
Structural Calculations of rotationally symmetrical shell structures by using the Finite Element Method



SYSTEM DESCRIPTION

System graphic

on r.h. side: node numbers, bearing information, orientation of the pos.; on l.h. side: number, thickness of the pos.



Coordinates and bearing information

node -	X m	Z m	Cf-X MN/m ²	Cf-Z MN/m ²	Cm-Y MNm/m	designat ion -
1	2.000	-0.500	-	-	-	
2	2.000	0.000	fest	fest	-	
4	0.001	0.000	-	-	-	
5	0.001	-0.500	-	-	-	

Calculation values of position 1:

Material designation: steel S235 (St37) with $\gamma_M, E_{mod}=1.00$

Geom. characteristic values	Phys. characteristic values	elastic bedding
Start node: 1	E-modulus: 210000.00 MN/m ²	no
End node: 2	Poisson's ratio: 0.30 -	
Length: 0.50 m	Temp. coeff.: 1.20 10 ⁻⁵ /K	
Thickn.: 4.00 cm		

Calculation values of position 3:

Material designation: steel S235 (St37) with $\gamma_M, E_{mod}=1.00$

Geom. characteristic values	Phys. characteristic values	elastic bedding
Start node: 2	E-modulus: 210000.00 MN/m ²	no
End node: 4	Poisson's ratio: 0.30 -	
Length: 2.00 m	Temp. coeff.: 1.20 10 ⁻⁵ /K	
Thickn.: 4.00 cm		

Calculation values of position 4:

Material designation: steel S235 (St37) with $\gamma_{M, Emod}=1.00$

Geom. characteristic values		Phys. characteristic values	elastic bedding
Start node:	5	E-modulus: 210000.00 MN/m ²	no
End node:	1	Poisson's ratio: 0.30 -	
Length:	2.00 m	Temp. coeff.: 1.20 10 ⁻⁵ /K	
Thickn.:	4.00 cm		

Description of loading structure

On the left-hand side, the relationship between the actions effects, load case file and load cases are shown in a tree structure. The right-hand side shows the characteristics of the superposition to the associated objects on the left-hand. In terms of the superposition, a load case file is equivalent to an extreme rule of the defined objects therein and can be additive or alternatively superpositioned.

Used symbols:



Action effect



Load case file



Load case



1: new action effect



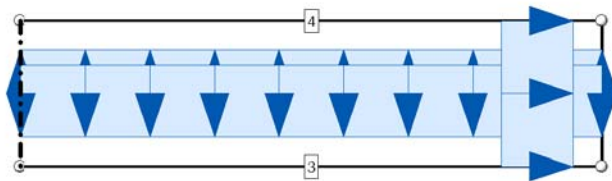
1: new load case

permanent loads

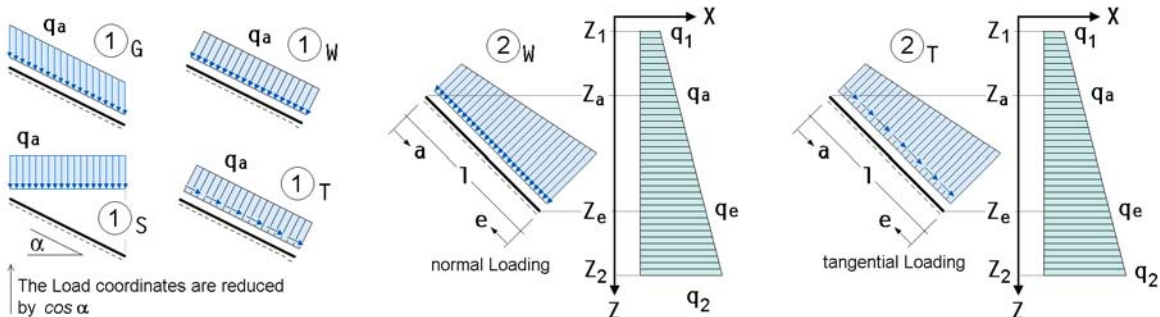
additive

LOAD PICTURES IN LOAD CASE 1: NEW LOAD CASE

Loaded objects in load case 1



Explanation of load types and load directions



Area loads in load case 1

Loads depending on Z-coordinate (type 2). Z₁ and Z₂ define the load interval. Thereby the positions are u.c. partially loaded. Subscript A refers to the load distance of the start node and subscript E to the load distance of the end node. l is the loaded section.

pos.	type	q _a kN/m ²	q _e kN/m ²	a m	l m	e m	z1 m	q1 kN/m ²	z2 m	q2 kN/m ²
4	1W	-80.000	-	-	1.999	-				
1	1W	-80.000	-	-	0.500	-				
3	1W	-80.000	-	-	1.999	-				

VERIFICATIONS

meanings in case of application of superposition rule acc. to Eurocode:

Ψ_{dom}	Combination coefficient of a leading traffic load action	(leading load action)
Ψ_{sub}	Combination coefficient of a non-leading traffic load action	(accompanying load action)
γ_{sup}	Partial safety factor for unfavourable load positions	
γ_{inf}	Partial safety factor for favourable load positions	

meanings in case of application of superposition rule acc. to DIN 18800:

Ψ_{dom}	Combination coefficient of a main combination
Ψ_{sub}	Combination coefficient of a minor combination

Superposition rules of bridge construction and DIN 1055-100 behave like Eurocode.
In non-linear analysis, rules of extremization will not be considered

If verifications according to Eurocode are listed below, the following applies:
The national annex "Germany" is taken into account.

Verification 1: Analysis

Analysis: Analysis no Verifications

1: Standard combination

Rules of extremization of verification 1, type: standard, rule of superposition: charakteristisch

action	γ_{sup}	γ_{inf}
1	1.00	1.00

List of beams of verification 1:

Line numbers ...
1 3 4

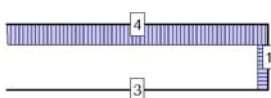
REGULATIONS

VERIFICATION 1: SUMMARY

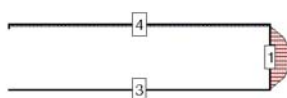
Extremal Reactions of supported nodes (γ_F -fach)

node type	a_{px} kN/m	a_{pz} kN/m	a_{my} kNm/m
-			
2 Min	-163.25	0.00	0.00
Max	-163.25	0.00	0.00
Minimum	-163.25	0.00	0.00
Maximum	-163.25	0.00	0.00

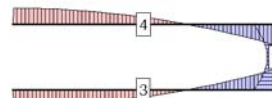
Normal force n_l
Min/Max: 0.00/158.35 kN/m



Normal force n_m
Min/Max: -1694.80/321.40 kN/m

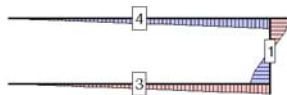
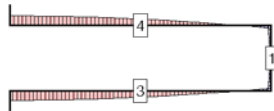


Internal moment m_l
Min/Max: -29.55/36.57 kNm/m



Internal moment m_m
Min/Max: -62.42/10.97 kNm/m

Shear force q_l
Min/Max: -158.35/163.25 kN/m



Extremal member forces

node	s	type	n1	n _m	m1	m _m	q1	
-	m		kN/m	kN/m	kNm/m	kNm/m	kN/m	
Shell 1								
1	0.00	Min	80.00	198.45	36.48	10.94	-158.35	
		Max	80.00	198.45	36.48	10.94	-158.35	
	0.10	Min	80.00	-1170.53	21.73	6.52	-124.94	
		Max	80.00	-1170.53	21.73	6.52	-124.94	
	0.20	Min	80.00	-1674.39	12.92	3.88	-46.60	
		Max	80.00	-1674.39	12.92	3.88	-46.60	
	0.30	Min	80.00	-1694.80	12.83	3.85	45.02	
		Max	80.00	-1694.80	12.83	3.85	45.02	
	0.40	Min	80.00	-1234.28	21.57	6.47	125.47	
		Max	80.00	-1234.28	21.57	6.47	125.47	
2	0.50	Min	80.00	85.28	36.57	10.97	163.25	
		Max	80.00	85.28	36.57	10.97	163.25	
Shell 3								
2	0.00	Min	0.00	0.00	36.57	8.62	-80.00	
		Max	0.00	0.00	36.57	8.62	-80.00	
	1.03	Min	0.00	0.00	-14.10	-20.58	-38.60	
		Max	0.00	0.00	-14.10	-20.58	-38.60	
	1.96	Min	0.00	0.00	-29.46	-29.50	-1.64	
		Max	0.00	0.00	-29.46	-29.50	-1.64	
	2.00	Min	0.00	0.00	-28.35	-30.71	-0.19	
		Max	0.00	0.00	-28.35	-30.71	-0.19	
	2.00	Min	0.00	0.00	-26.30	-33.38	-0.11	
		Max	0.00	0.00	-26.30	-33.38	-0.11	
4	2.00	Min	0.00	0.00	-0.00	-62.24	-0.00	
		Max	0.00	0.00	-0.00	-62.24	-0.00	
Shell 4								
5	0.00	Min	0.00	321.40	-0.00	-62.42	0.00	
		Max	0.00	321.40	-0.00	-62.42	0.00	
	0.00	Min	142.62	169.23	-26.38	-33.49	0.11	
		Max	142.62	169.23	-26.38	-33.49	0.11	
	0.03	Min	158.23	158.48	-29.55	-29.61	1.32	
		Max	158.23	158.48	-29.55	-29.61	1.32	
	0.96	Min	158.35	158.35	-14.19	-20.67	38.60	
		Max	158.35	158.35	-14.19	-20.67	38.60	
	1	2.00	Min	158.35	158.35	36.48	8.53	80.00
			Max	158.35	158.35	36.48	8.53	80.00
Minimum			0.00	-1694.80	-29.55	-62.42	-158.35	
Maximum			158.35	321.40	36.57	10.97	163.25	