

**Program: RFEM 5**

**Category: Large Deformation Analysis, Isotropic Linear Elasticity, Member**

**Verification Example: 0047 – Snap Through with Spring Supports**

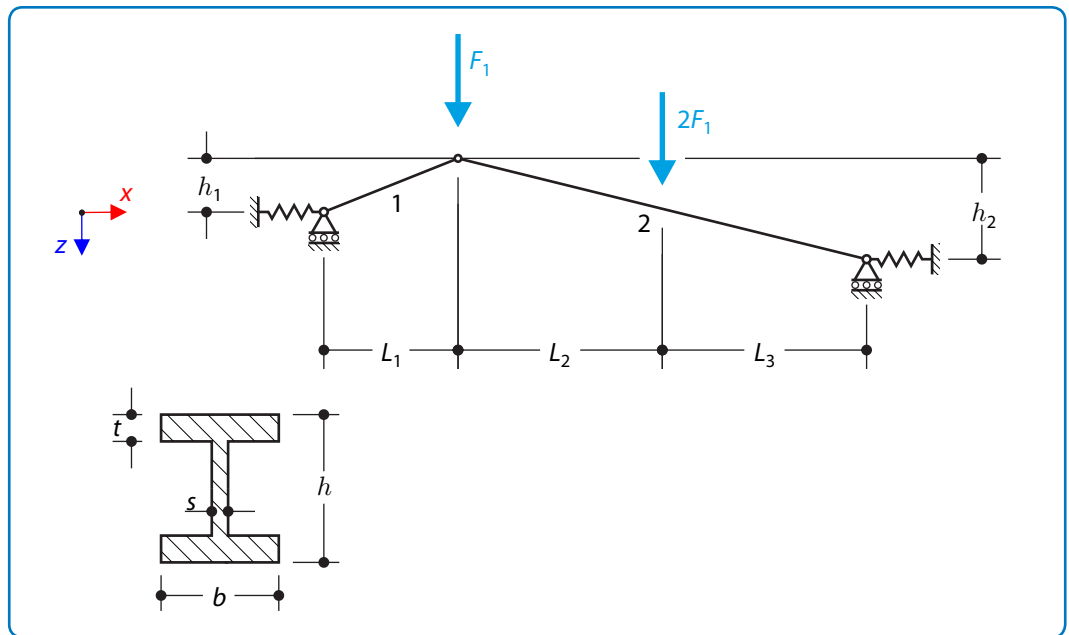
## 0047 – Snap Through with Spring Supports

### Description

A structure made of I-profile trusses is supported on the both ends by the spring sliding supports and loaded by the transversal forces according to the **Figure 1** [1]. The problem is described by the following set of parameters.

Material	Steel	Modulus of Elasticity	$E$	210000.000	MPa
		Poisson's Ratio	$\nu$	0.300	–
Geometry	Structure	Section Length 2	$L_1$	2.000	m
		Section Length 2	$L_2$	4.000	m
		Section Length 3	$L_3$	4.000	m
		Height 1	$h_1$	0.130	m
		Height 2	$h_2$	0.520	m
	Cross-Section	Height	$h$	400.000	mm
		Width	$b$	180.000	mm
		Web Thickness	$s$	10.000	mm
		Flange Thickness	$t$	14.000	mm
Load	Transverse Force	$F_1$	10.000	kN	
	Spring Stiffness	$c_{u,x}$	84000.000	kN/m	

The self-weight is neglected in this example. Determine the maximum deflection of the structure  $u_{z,max}$ , the maximum bending moment  $M_{y,max}$ , the normal force in the truss 2  $N$  and horizontal deflection of the spring supports  $u_{x,max}$ .


**Figure 1:** Problem sketch

### Analytical Solution

Analytical solution is not available for this example.

### RFEM 5 Settings

- Modeled in RFEM 5.05.0029
- The element size is  $l_{FE} = 0.200$  m
- The number of increments is 5
- Isotropic linear elastic material model is used
- The structure is modeled using members
- Shear stiffness of the members is neglected
- Large deformation analysis is used

### Results

Structure Files	Program
0047.01	RFEM 5

Quantity	S3D [2]	RFEM 5	Ratio [-]
$u_{z,max}$ [mm]	53.8	53.7	0.998
$M_{y,max}$ [kNm]	41.0	41.0	1.000
$N$ [N]	-209.0	-208.4	0.997
$u_{x,max}$ [mm]	2.47	2.47	1.000

### References

- [1] LUMPE, G. and GENSICHEN, V. *Evaluierung der linearen und nichtlinearen Stabstatik in Theorie und Software: Prüfbeispiele, Fehlerursachen, genaue Theorie*. Ernst.
- [2] LUMPE, G. *S3D (Vers. 25.09.2011)*. Hochschule Biberach.