SDLD25 - Spring-mass system with viscous damper proportional (spectral response)

Summarized

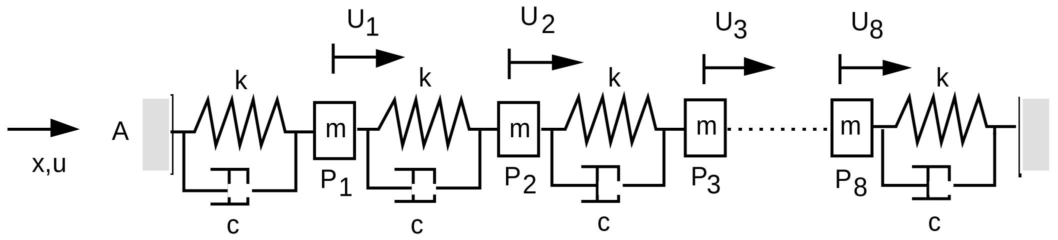
This one-way problem consists in carrying out a spectral seismic analysis of a mechanical structure made up of a set of mass-springs with viscous dampers subjected to a seismic request provided in the shape of a response sprectrum of oscillators pseudonym in acceleration.

Via this problem, one tests modal combination SRSS of operator `COMB_SISM_MODAL` [U4.54.04]. In addition, one tests several operators of pre - processing; `DEFI_FONCTION` and `DEFI_NAPPE`.

This test is also a test of resorption of LICE. There are no differences between the Code_Aster results and the LICE results.

1 Problem of reference

1.1 Geometry



Point masses: $m_{P_1} = m_{P_2} = m_{P_3} = \dots \dots = m_{P_8} = m$

Stiffness of connection: $k_{AP1} = k_{P1P2} = k_{P2P3} = \dots \dots = k_{P8B} = k$

Viscous dampings: $c_{AP1} = c_{P1P2} = c_{P2P3} = \dots \dots = c_{P8B} = c$

1.2 Material properties

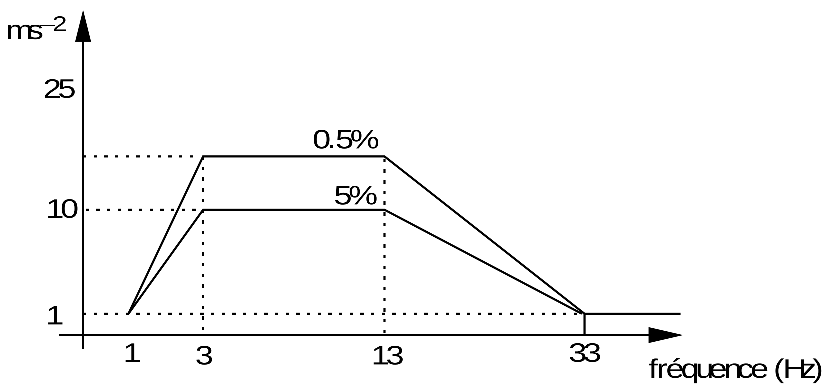
Comes out from elastic translation linear $k = 10^5 N/m$
Point mass $m = 10 kg$
one-way Viscous damping $c = 50 N/(m/s)$

1.3 Boundary conditions and loadings

Not A and B : embedded ($u = 0$)

Spectrum of acceleration to the bearings $\ddot{u}(f, a)$ normalized at $1. m s^{-2}$

Points A and B : $\ddot{u} = \ddot{u}(f, a)$



2 Reference solution

2.1 Method of calculating used for the reference solution

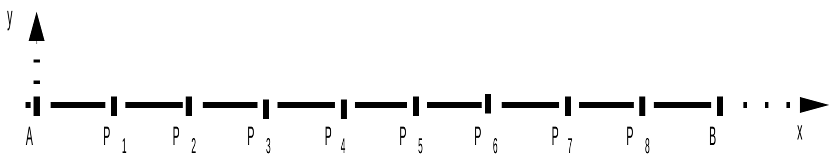
Comparison with other codes.

2.2 Results of reference

Absolute acceleration according to x the points A $P1$ $P2$ $P3$ $P4$.

3 Modelization A

3.1 Characteristic of the modelization



Characteristics of the elements:

`DISCRET`	with nodal masses	`M_T_D_N`
	and limiting	`stiffness matrixes`
	K_T_D_L and	`damping matrixes`

A_T_D_L Conditions:

in all nodes	`DDL_IMPO`	`(TOUT=' OUI'    DY = 0. , DZ = 0. )`
with the nodes ends		`(GROUP_NO =  “AB”, DX = 0. )`

Names of the nodes:

Not A = $N1$ $P_1 = N2$

Not B = $N10$ $P_2 = N3$

....

$P_8 = N9$

3.2 Characteristic of the mesh

Many nodes: 10

Number of meshes and types: 9 `SEG2`

3.3 Quantities tested and results

Identification	Reference LICE	Non regression	Tolerance Reference	Tolerance
Eigenfrequencies				
1	5.53	0.001	5.525	0.001
2	10.89	0.001	10.887	0.001
3	15.92	0.001	15.924	0.001
4	20.46	0.001	20.461	0.001
5	24.38	0.001	24.390	0.001
6	27.57	0.001	27.566	0.001
7	29.91	0.001	29.911	0.001
8	31.35	0.001	31.347	0.001
Quantity localization				
`ACCE_ABSOLU` A DX	1.0	0.15	1.136	0.001
$P1$ DX	10.45	0.001	10.450	0.001
$P2$ DX	19.03	0.001	19.030	0.001
$P3$ DX	25.32	0.001	25.318	0.001
$P4$ DX	28.95	0.001	28.946	0.001

3.4 Remarks

Mode	1	2	3	4	5	6	7	8
Damping (in %)	0.868	1.710	2.500	3.213	3.830	4.331	4.698	4.924
Spectrum	23.19	19.54	9.033	3.928	2.282	1.601	1.283	1.136

4 Summary of the results

the Aster *results* are identical to LICE results until the second decimal. The variation on absolute acceleration at the point A is due to the design assumption of the different pseudo-mode between LICE and *Code_Aster*.