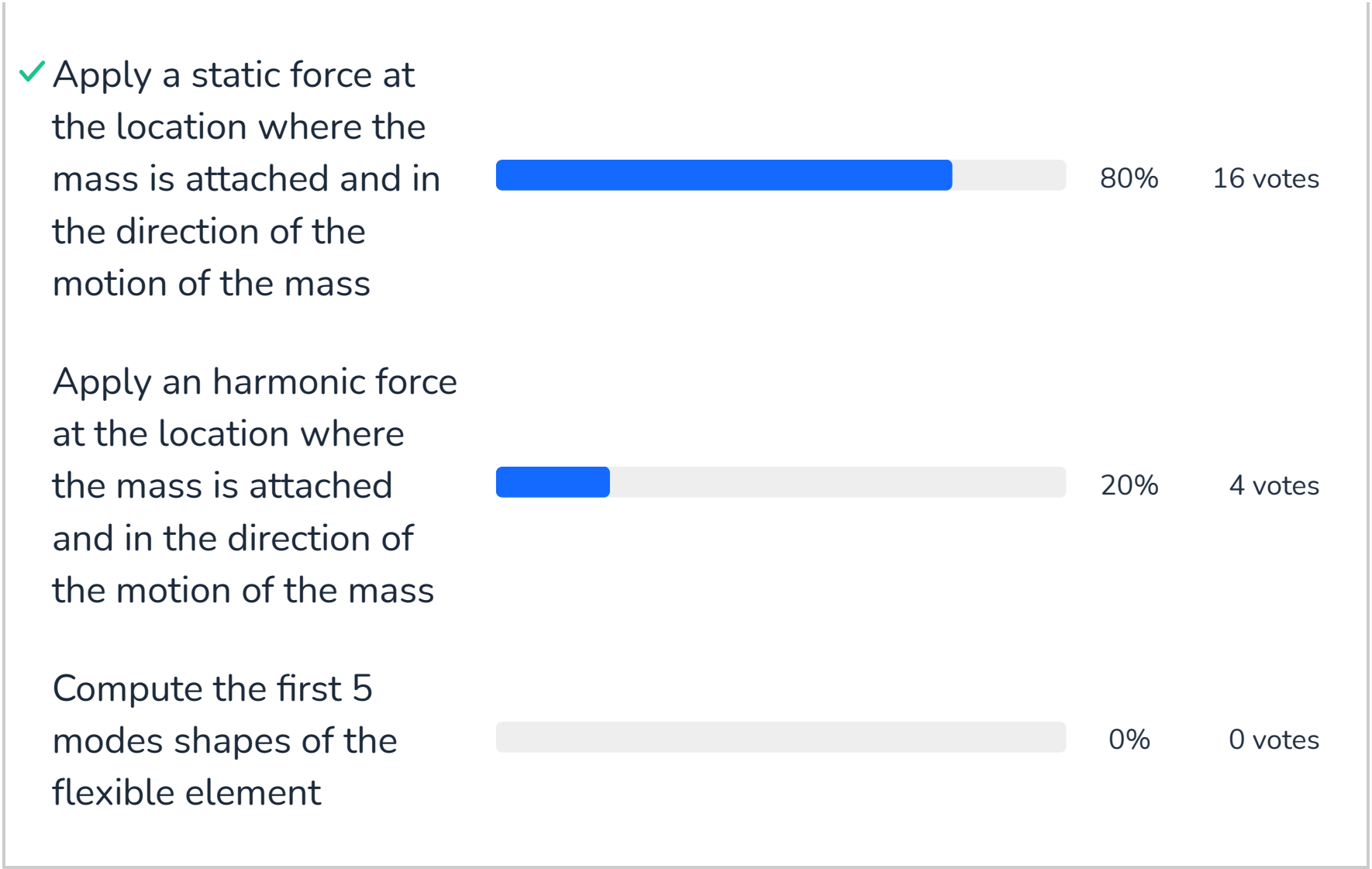
VIB 2021 : Equivalent SDOF system

Number of participants: 37

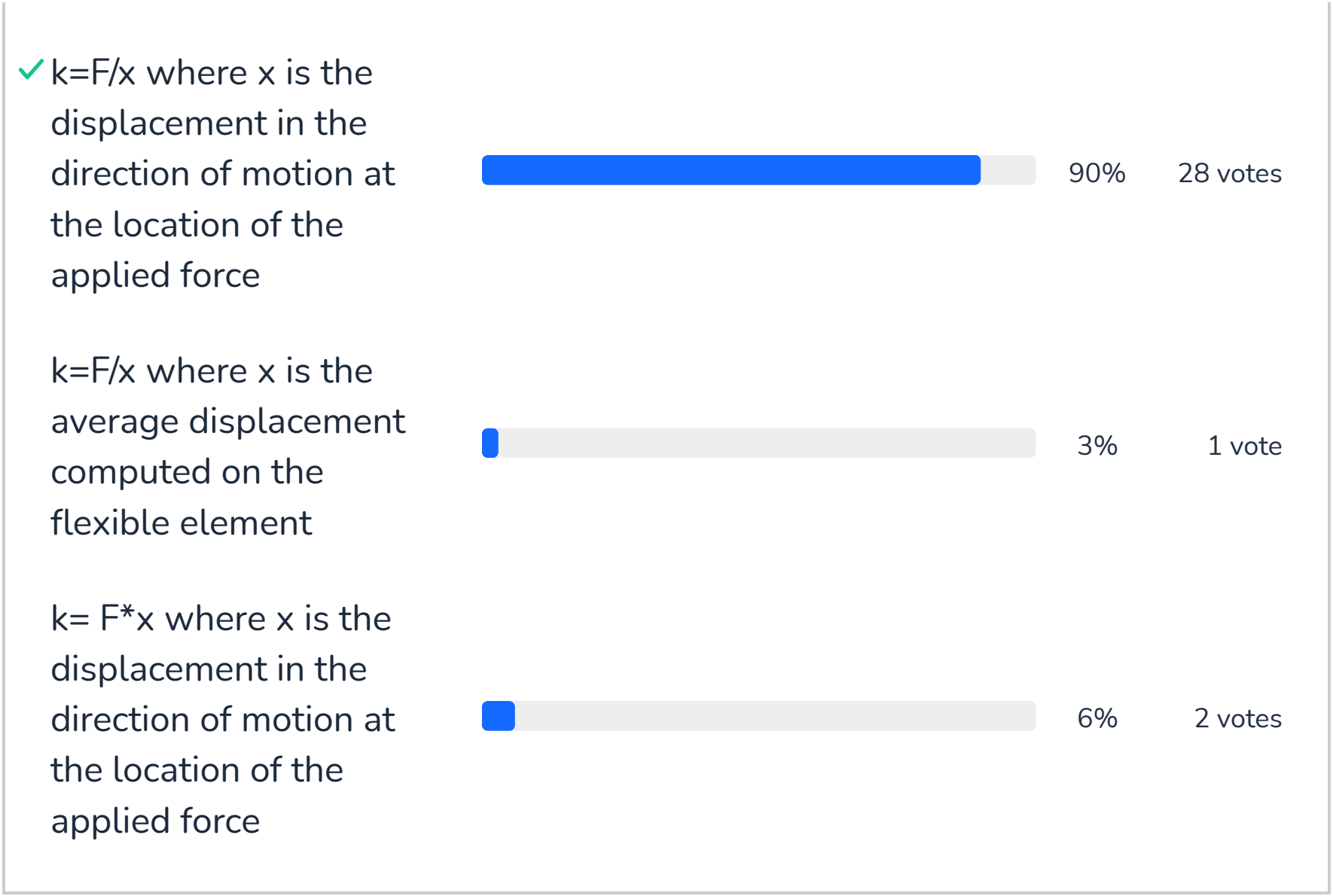
1

In order to compute an equivalent stiffness, one needs to


✓ Apply a static force at the location where the mass is attached and in the direction of the motion of the mass
80%
16 votes
Apply an harmonic force at the location where the mass is attached and in the direction of the motion of the mass
20%
4 votes
Compute the first 5 modes shapes of the flexible element
0%
0 votes

2

The equivalent stiffness is then given by


✓ k=F/x where x is the displacement in the direction of motion at the location of the applied force
90%
28 votes
k=F/x where x is the average displacement computed on the flexible element
3%
1 vote
k= F*x where x is the displacement in the direction of motion at the location of the applied force
6%
2 votes

3

For a bar in traction with section A, young's modulus E and length L, the equivalent stiffness is given by

k = E A L		0%	0 votes
✓ k=EA/L		100%	18 votes
k=E/(A*L)		0%	0 votes

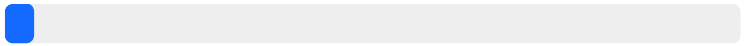
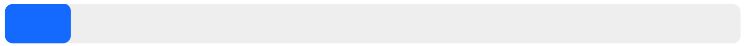
4

Consider a cantilever beam with a mass attached at the tip. If the length of the bar is doubled, the first natural frequency is

multiplied by 2	12%	3 votes
divided by 2	56%	14 votes
✓ divided by 2 sqrt(2)	8%	2 votes
divided by 4	24%	6 votes

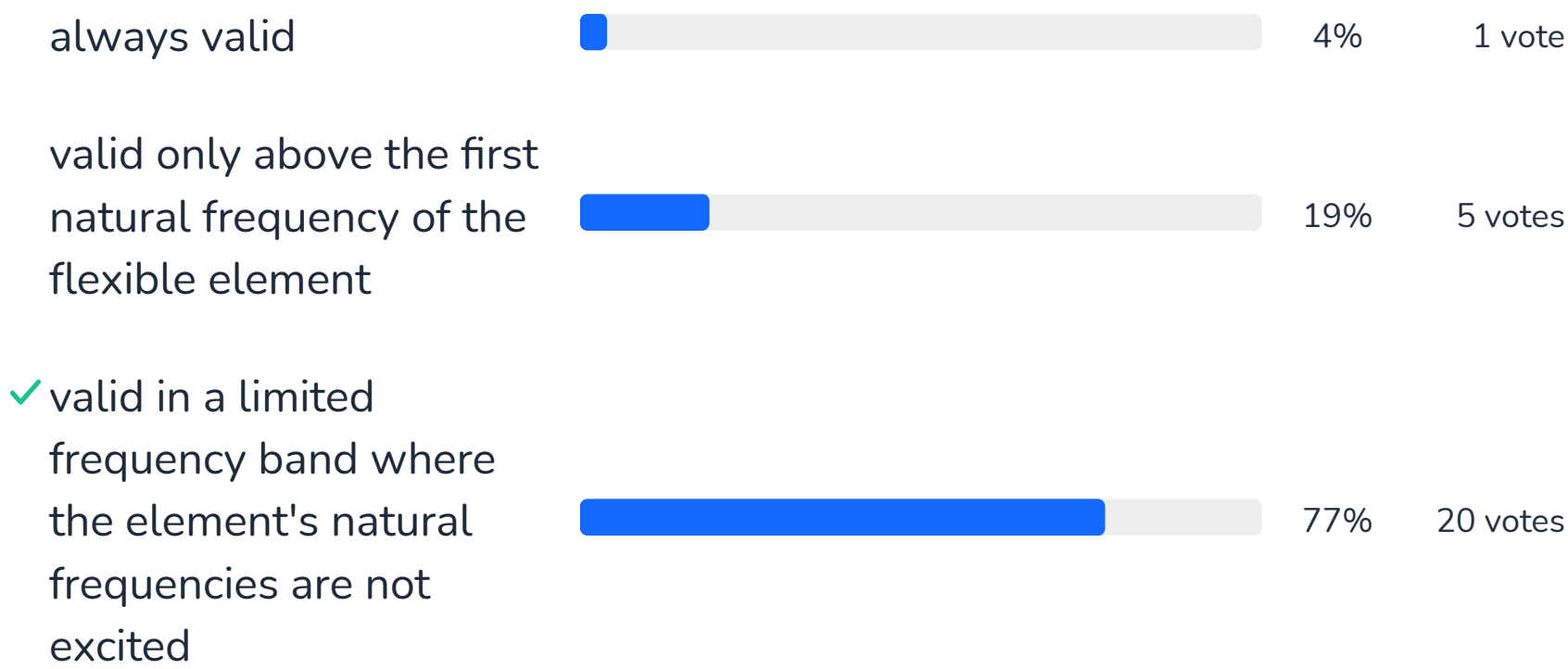
5

To compute the equivalent mass of a flexible element simplified by a spring element, one needs to

use the principle of d'Alembert		4%	1 vote
compute the total mass of the flexible element and divided it by 3		9%	2 votes
✓ equate the kinetic energy of the flexible element with the one of the additional mass located at the tip of the spring		87%	20 votes

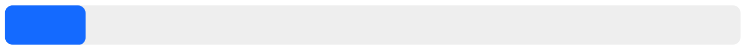
6

When replacing a flexible element by a spring, the approximation is



7

A complex structure can be represented by an equivalent mass-spring model using

✓ the principles of equivalent mass and spring if the structure is made of a large mass attached to a flexible element		89%	16 votes
✓ a single mode approximation if the eigenfrequencies are well separated		28%	5 votes
✓ the principle of equivalence of kinetic		11%	2 votes

and strain energy

8

When using single mode approximation, the equivalent mass and stiffness of the SDOF system depend on