**The laboratory work 7**

A vertical massless elastic rod of length l with constant section stiffness EJ is given. The concentrated weight is connected to the end of the rod by the mass m. The upper support of the rod is a fixed hinge, and the lower support is a movable sleeve with a ball bearing.



The distance between supports s <l is not constant and varies due to movement alternately with a period of 30 seconds in one of two harmonic laws:

*s = H1cos(w1t)* (1)

*s = H2sin(w1t)* (2)

where H1 and H2 are the oscillation amplitudes, w1 is the oscillation frequency.

The oscillation frequency, regardless of the law of oscillation, every 20 seconds, decreases by 40%, then returns to the previous value. The equilibrium state corresponds to the position of the load on the vertical and the rectilinear shape of the axis of the rod. When this state is disturbed, the load deviates to the side, the beam axis bends, and the subsequent motion is described by a differential equation:



At the initial time, the load deviates by a distance x0. If x exceeds the threshold value xmax, then the rod is destroyed. Construct a model of this system.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variant | l | EJ | m | H1 | H2 | w | x0 | xmax |
| 1 | 5 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.5 m | 2 m | $$1 s^{-1}$$ | 0.1 m | 3 m |
| 2 | 6 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1 m | 1.5 m | $$0.9 s^{-1}$$ | 0.2 m | 4 m |
| 3 | 7 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.8 m | 2.2 m | $$0.7 s^{-1}$$ | 0.3 m | 4 m |
| 4 | 8 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.3 m | 2.4 m | $$1.1 s^{-1}$$ | 0.4 m | 9 m |
| 5 | 9 m  | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.1 m | 1.9 m | $$1.2 s^{-1}$$ | 0.5 m | 5 m |
| 6 | 10 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.9 m | 2.8 m | $$1.3 s^{-1}$$ | 0.6 m | 6 m |
| 7 | 11 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.4 m | 2.6 m | $$0.7 s^{-1}$$ | 0.7 m | 8 m |
| 8 | 12 m | $$1 kg\*m^{3}/s^{2}$$ | 1 kg | 1.3 m | 2.1 m | $$0.9 s^{-1}$$ | 0.8 m | 11 m |