**The laboratory work 5**

A rigid flat plate of length l is located in a flow of gas (liquid), which velocity V is directed along the middle plane of the plate in unperturbed state of equilibrium (Fig.).



In this position, the aerodynamic forces are zero and the plate is in equilibrium under the influence of gravity and the reaction of supports. When the plate deviates, aerodynamic pressures arise, which depend on the angle of deviation of the plate φ. At the initial moment, the plate deviates from the equilibrium position by an angle of 0.01 degrees.  
Let I be the moment of inertia of the plate relative to the hinge axis; then the differential equation of motion will be:



where c0 is the coefficient of spring stiffness, ky is the constant aerodynamic coefficient, ρ - gas density, b - distance from the hinge axis, which determines the point of application of the resultant aerodynamic pressures to the plate.

The equation 1 is executed when Otherwise, under the influence of aerodynamic forces, the plate again returns to the equilibrium position. Every 5 seconds the speed of the supplied gas is increased by 50%, then it returns to the previous value. Also, every 10 seconds, the gas density is then increased by 50%, then it returns to the previous value.

Build a model of this system

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variant | l | V | J | c0 | ky | ρ | b |
| 1 | 5 m | 1 m/s | 1 kg \* m2 | 0.5 kg/s2 | 0.5 m \* s2 | 2 kg/m3 | 1 m |
| 2 | 8 m | 2 m/s | 2 kg \* m2 | 0.6 kg/s2 | 0.6 m \* s2 | 3 kg/m3 | 1.3 m |
| 3 | 10 m | 5 m/s | 4 kg \* m2 | 0.7 kg/s2 | 0.7 m \* s2 | 4 kg/m3 | 0.3 m |
| 4 | 15 m | 3 m/s | 6 kg \* m2 | 0.8 kg/s2 | 0.8 m \* s2 | 5 kg/m3 | 0.9 m |
| 5 | 20 m | 2 m/s | 8 kg \* m2 | 0.9 kg/s2 | 0.9 m \* s2 | 6 kg/m3 | 2.3 m |
| 6 | 25 m | 3 m/s | 5 kg \* m2 | 1.8 kg/s2 | 0.7 m \* s2 | 4 kg/m3 | 2.6 m |
| 7 | 12 m | 5 m/s | 6 kg \* m2 | 1.9 kg/s2 | 0.8 m \* s2 | 5 kg/m3 | 1.1 m |
| 8 | 18 m | 2 m/s | 9 kg \* m2 | 2.7 kg/s2 | 1.1 m \* s2 | 7 kg/m3 | 1.6 m |