Methodological Notes

DEMONSTRATION OF THE ROLE OF THE AXIS OF "FREE ROTATION" OF A BODY

S. P. Strelkov

A "somersaulting" cylinder provides a single and instructive lecture demonstration of the direction of the principal axes of inertia of a body (the axes of "free rotation"). A homogeneous cylinder is prepared from a light material (foam plastic, light wood, pasteboard, etc.). Two small lead (or iron) weights are attached to the ends of the cylinder (see drawing), being located symmetrically relative to the center of the cylinder. They are placed so that their center of mass lies on the axis of the cylinder.

In slow rolling along a flat surface, the cylinder turns as if it were homogeneous. In an attempt to make the cylinder rotate with high speed, the cylinder jumps irregularly and even begins to flip over. An especially graphic demonstration is rotation on an inclined plane, in which an ordinary homogeneous cylinder and then a "somersaulting" one of the same dimensions are set in motion.
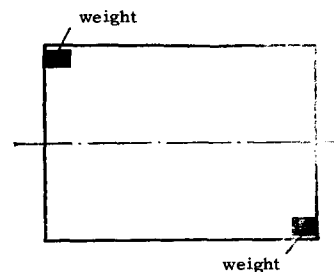
The experiment can be conducted for arbitrary masses and dimensions. It is best to take a cylinder of foam plastic with dimensions similar to those shown in the drawing. The mass of the weight used is much larger than the mass of the cylinder, and the surface of the inclined plane should be roughened.

Translated by R. T. Beyer

FOUR LECTURE DEMONSTRATIONS FOR COURSES ON THE THEORY OF OSCILLATIONS AND RADIO ENGINEERING

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I. NATURAL OSCILLATIONS IN A REGENERATIVE OSCILLATING CIRCUIT. THE PROCESS OF BUILDING UP OSCILLATIONS OF A QUASI-HARMONIC CHARACTER IN AN LC OSCILLATOR

IT is easy to produce a demonstration of oscillatory processes in a regenerative circuit and in an LC oscillator by using a transistor as the active element of the system, for the following reasons: 1) as a consequence of the large difference in the values of the input ($\sim 10^2$ ohms) and output ($\sim 10^6$ ohms) resistances of the transistor, the condition for self-excitation in the oscillator with transformer coupling is satisfied if the feedback coil consists of only several turns, and can be easily wound during the demonstration; 2) the supply voltages of the transistor are low and it is quite safe to experiment with such an oscillator under lecture conditions.

The experimental apparatus described makes it possible to demonstrate the following phenomena in a large auditorium.

1. Natural damped oscillations in an LC circuit and the dependence of their form on the decrement of the circuit.

2. Increase in the damping of the natural oscillations in the circuit in the presence of negative feedback.

3. Decrease in the damping of natural oscillations in a regenerative circuit for positive feedback below critical.

4. The process of building up oscillations in a generator of quasi-harmonic oscillations for different values of the positive feedback and various initial conditions.

The apparatus makes it possible to observe the shape of stationary auto oscillations in a circuit out-