A STUDY OF VIBRATIONS OF STRUCTURES IN NATURE

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ABSTRACT

The existing analytical formulas for the determination of the period of free vibrations of structures yield, for the most part, inadequate values because of the conditionality of the choice of the design scheme and the assumption made to facilitate the calculation. Hence the necessity to determine experimentally the dynamic characteristics of structures (the period of free vibrations and the logarithmic decrements of damping).

We have investigated apartment houses, public and industrial buildings and structures (about 70 in number), made of stone, reinforced concrete (prefabricated parts and monoliths) and metal, erected on various grounds (basalt, tufa, pebble, gravel, clay sandy loams). The vibrations were set up by blasts or microseisms. The recording of the vibrations was effected by a mobile seismic laboratory equipped with corresponding seismomeasuring devices. Let us consider the results of the experiments on a few of the structures.

The values of the frequency of the fundamental tune of free vibrations is indicated for all the investigated buildings (one to ten story high). Relying on the values of the frequencies of the derived vibrations and also on the dimensions of the buildings and their heights, we have found it possible to conceive of the value of the period of vibration (the fundamental tune) in terms of the smallest dimensions of the building -b, the height -h and some co-efficient -k which is mainly contingent on the ground on which the foundation of the building is laid and also on the type of the construction.

The records of the vibrations of a number of buildings have shown that in addition to the fundamental tune of the vibration a second tune has been detected which in the case of 4-6 storey stone buildings can be approximately expressed by the formula:

$$T_2 = \tfrac{1}{3} T_1 \qquad \text{where} \quad T_1 = k \frac{h}{\sqrt{b}}$$