Identification of natural oscillation frequencies of constructions from low–amplitude seismic signals (on the example of the Sayano–Shushenskaya HPP dam according to the monitoring data of 2001–2021)

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Abstract Based on the spectral analysis of low-amplitude seismic signals records (continuous monitoring data for 2001-2021) from one of the stations of the seismological network located at a distance of 4.4 km from the Sayano-Shushenskaya HPP, a method for determining the daily values of natural oscillation frequencies of constructions has been developed (the frequencies of the first seven modes are identified with an error no more than 0.01 Hz). The results of processing and analysis of unique data indicate a continuous and non–slowing increase in the values of the natural oscillation frequencies of the dam in the range of 0.02-0.05 Hz during the observation period. This is explained either by silting up the bottom of the reservoir in the area adjacent to the dam, or by adapting the dam and its base with subsequent increase in mechanical rigidity of the construction. At the same time, the intervals are analyzed at which the influence of seasonal environmental influences on the construction is insignificant (summer-autumn period, the water level in the reservoir is close to the maximum). The developed method of identification of natural oscillation frequencies of constructions from low-amplitude seismic signals is intended to monitor their technical condition, in order to prevent the risks of destruction of dams, industrial structures, infrastructure facilities and civil buildings with a high degree of reliability and is economically profitable in comparison with known solutions.

Keywords Method of identification of natural oscillation frequencies, low-amplitude seismic signals, control of technical condition of constructions.

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