

Features of the monitoring of natural frequencies of hydro power plant dams (on the example of the Chirkey dam)

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Abstract A method is proposed for monitoring the natural frequencies of hydro power plant dams using continuous seismic observation data. The object of the research is the largest in Russia arched Chirkey dam located in the Caucasus. At the initial stage, a detailed study of the natural oscillations of the dam was performed using the method of coherent restoration of the standing wave fields with the definition of both the natural frequencies of the structure and their modes. The features of seasonal changes in the total field of standing waves are studied and factors affecting changes in natural frequencies are established. At the next stage, the values of natural frequencies were determined from the spectra of microseismic oscillations recorded by seismic equipment installed on the object. Observation points located in the antinodes of standing waves were used. The values of the natural frequencies of the Chirkey dam, as a whole, decrease with increasing upstream level. It was determined that there are additional factors leading to the hysteresis effect in the relationship between the values of the upstream level and natural frequencies, presumably associated with relaxation processes in the dam body and/or in the dam-base system after the change of level. A method for monitoring the state of the dam is proposed, based on a comparison of the observed values of natural frequencies with the predicted ones. The latter are determined by linear dependencies on the upstream level, taking into account the time shifts associated with relaxation processes.

Keywords arched Chirkey dam, the standing wave fields, monitoring the natural frequencies.

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