ДИНАМИЧЕСКОЕ ПОВЕДЕНИЕ ГРУНТОВОЙ ПЛОТИНЫ С УЧЕТОМ СТРУКТУРНЫХ ИЗМЕНЕНИЙ ПРИ ДЕЙСТВИИ ГАРМОНИЧЕСКИХ НАГРУЗОК

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Аннотация:
Рассматривая грунтовую среду как двухфазную среду в этих работах учтена водонасыщенность грунта. Однако решения подобных задач для различных плотин получены в начальные моменты времени (порядка 1/1000 сек). В приведенном во второй главе диссертации метод решения позволяет применение более сложных уравнений состояния грунтов как двухфазной среды, так и однофазной с учетом влажности, а также с учетом структурных разрушений материала плотины.

Ключевые слова: Грунтовая плотина, численные решения, увлажненность, напряженно-деформированного состояния

DYNAMIC BEHAVIOR OF AN EARTHDAM IN CONSIDERATION OF STRUCTURAL CHANGES UNDER THE ACTION OF HARMONIC LOADS

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Abstract:
Considering the soil medium as a two-phase medium, these works take into account the water saturation of the soil. However, solutions of similar problems for various dams were obtained at initial times (of the order of 1/1000 sec). In the second chapter of the dissertation, the solution method allows the use of more complex equations of the state of soils of both a two-phase medium and a single-phase medium, taking into account moisture, as well as taking into account structural destruction of the dam material

Key words: Earth dam, numerical solutions, moisture content, stress-strain state

Let us consider the stress-strain state of an earth dam under the action of a load in the vertical direction only in the absence of body forces. Let us assume that under the action of a seismic load, the foundations of the dam make a sinusoidal movement with an amplitude of 0.15 m and an oscillation period of 2 seconds, shown in Fig. 1

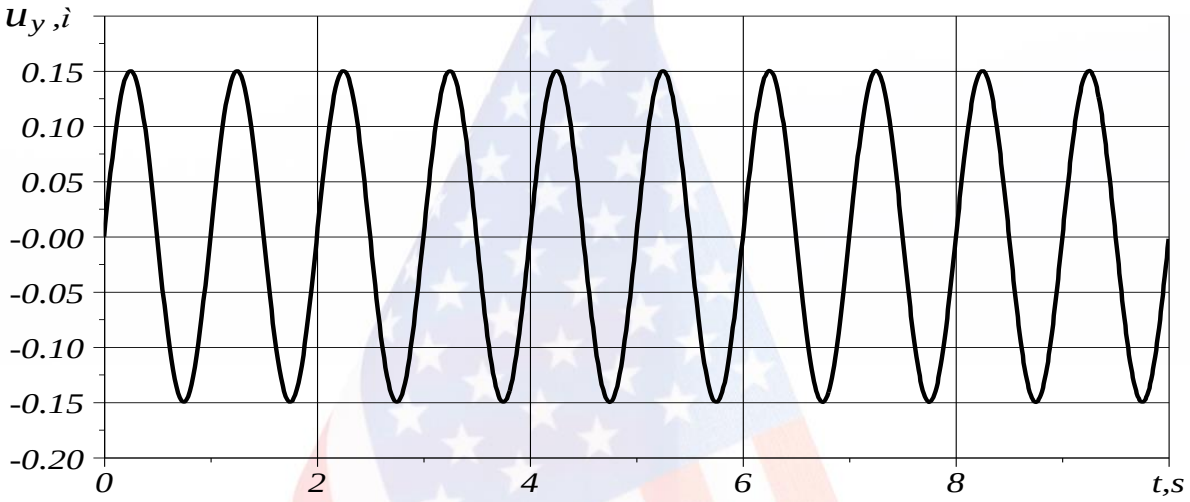


Fig. 1. Variation in particle velocity of the dam foundation

Plastic flow zones, i.e. zones, where I_S=1, under the action of harmonic load are shown in Fig.3.2. It can be seen that plastic deformations are experienced by particles located in the upstream and near-ridge parts of the dam. Fig.3 shows changes in shear deformations over time at points 1, 2, 3 and 4 (respectively, with coordinates {329, 127} located in the near-top zone of the upper slope; {98, 37} - in the upper part of the slope at the base; {342, 37}-in the center of the core at the bottom of the base and {342, 80} in the center of the dam core). As can be seen from Fig. 3, significant shear deformations occur in the central part of the dam, i.e. in the core of the dam, where the strength characteristics are much less than in the rockfill slope zones

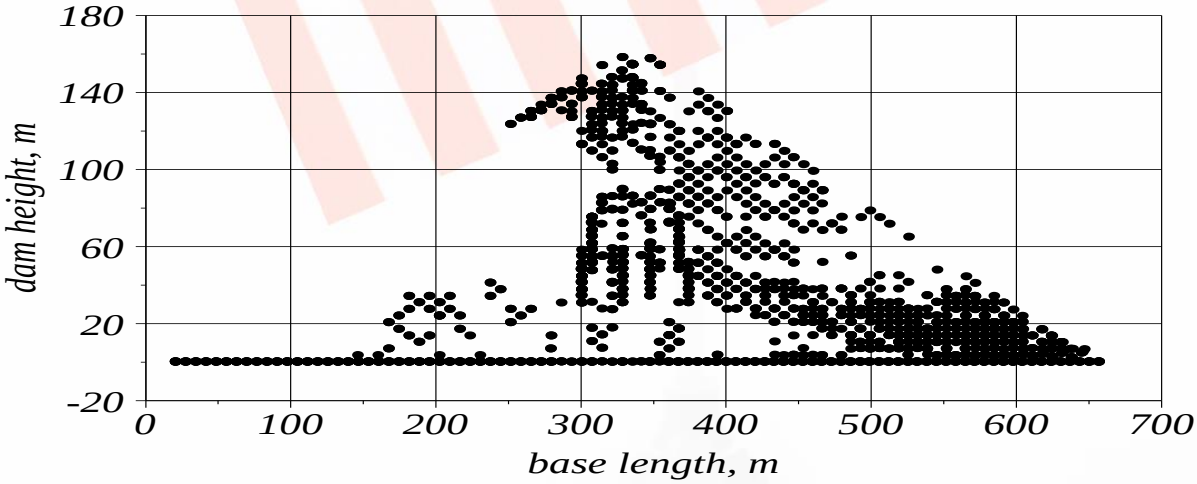


Fig.2. Zones of plastic deformation in the body of the dam

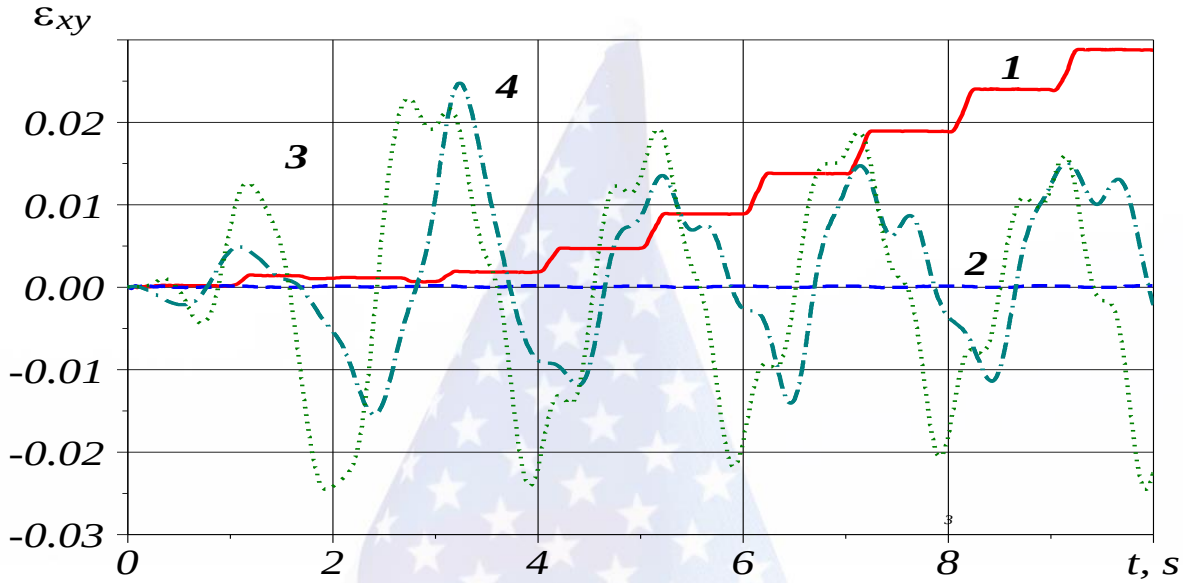
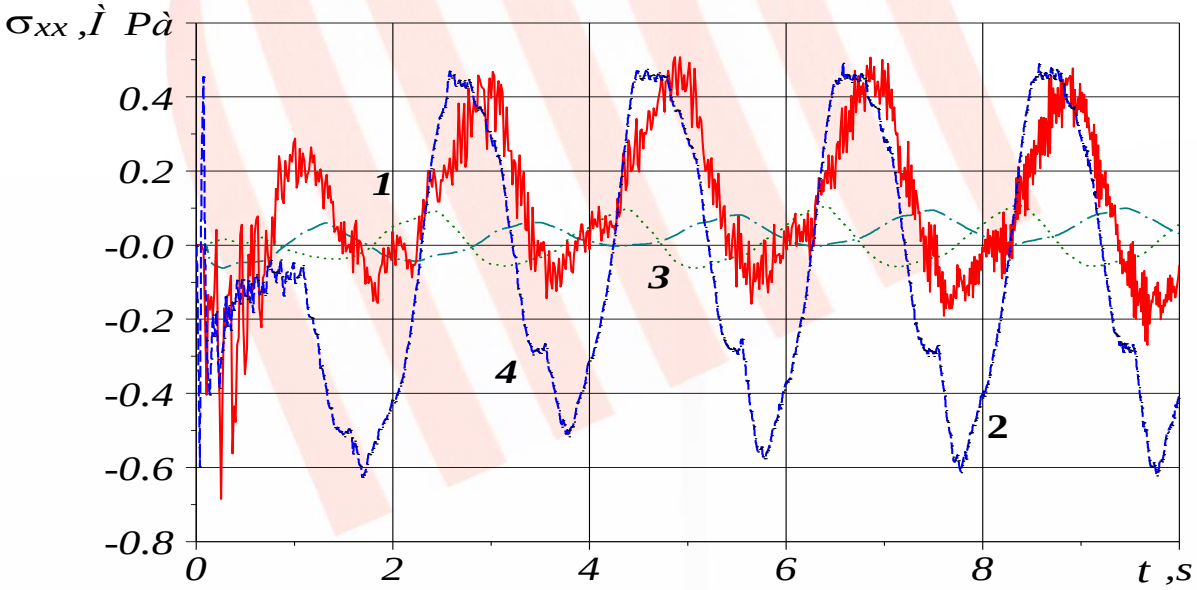


Fig.3. Change in shear strain over time.

Fig.4 shows the change in σ_{xx} and σ_{yy} over time at points 1, 2, 3 and 4. Significant stresses are observed in the rockfill parts of the dam compared to the "soft" core of the dam. At points 1 and 2, located in slope zones, multiple wave reflections from free slope surfaces are observed. In the case of vertical longitudinal stresses (Fig. 4), all stresses are comparable, i.e. the difference in values is small.



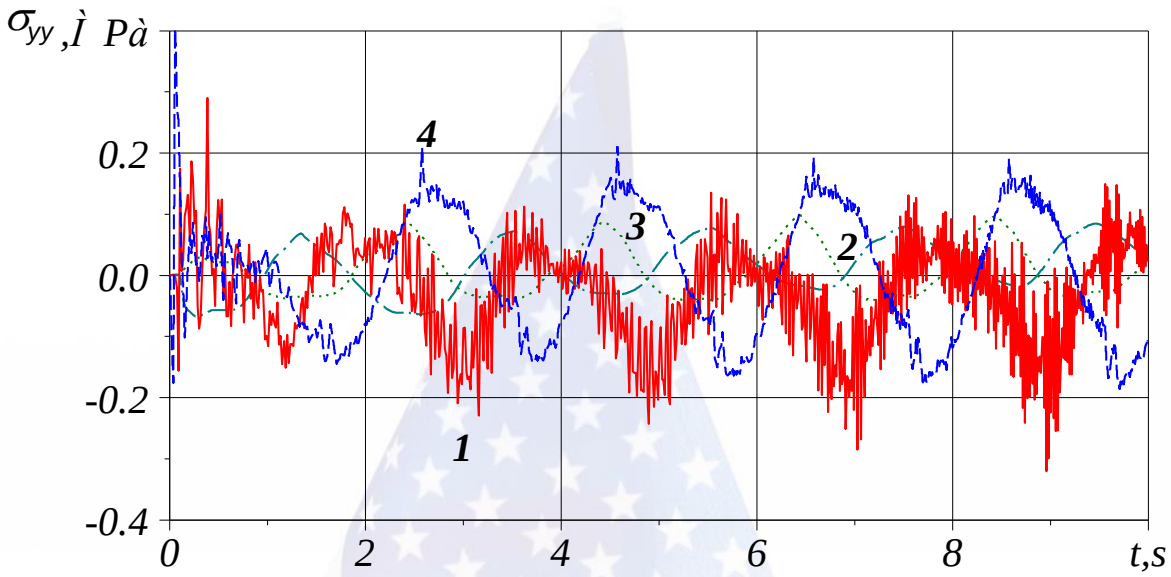


Fig.4. Change in voltage over time

The stress-strain state at the initial moment of time, approximately at t=2s, is the most unfavorable state. High values of stresses and residual deformations, as well as displacements in the slope and ridge zones of the dam can lead to the destruction of the arch or slope zones of the dam. High-frequency loads accompany the growth of stresses and the occurrence of vast zones of transcendent states of an earth dam.

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