8TH INTERNATIONAL MARDIN ARTUKLU SCIENTIFIC RESEARCHES CONFERENCE

JUNE 4-6, 2022, MARDİN, TURKEY

THE BOOK OF ABSTRACTS ON APPLIED SCIENCES

EDITED BY

DR. GHANSHYAM BARMAN

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DAMPING OF LIQUID SLOSHING IN STORAGE TANKS FROM SEISMIC LOADS

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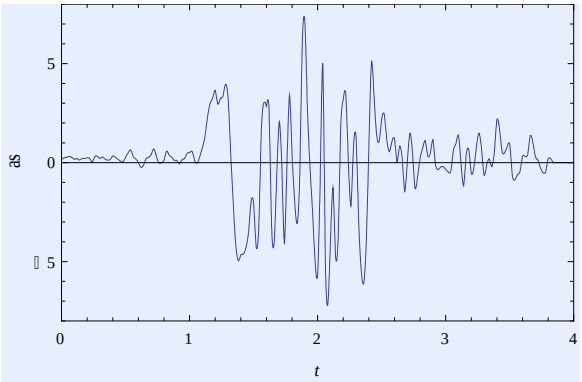
ABSTRACT

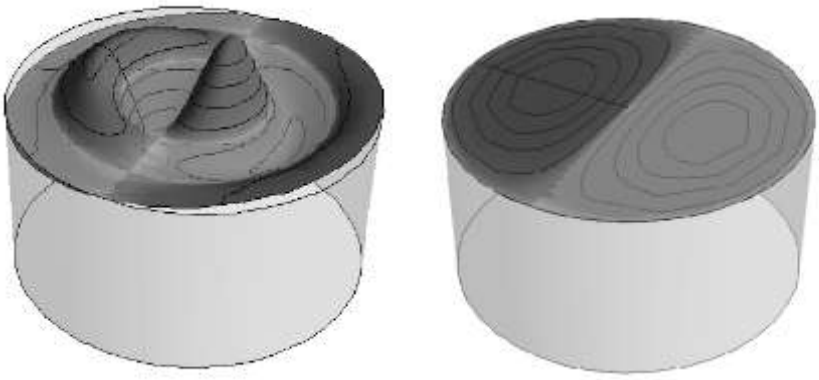
Seismic loads acting on reservoirs partially filled with liquid, cause the sloshing phenomenon in it. The partially filled tanks could be exposed to particularly strong sloshes. The strong movement of the liquid could create the high localized pressure of the liquid on the tank walls, which in turn could lead to the tank structure destruction or to the loss of its stability. The ingress of hazardous liquids from the tanks for their storage into the environment and their further spread to the settlements territory could cause mass poisoning of people and animals, lead to environmental components pollution. Liquid spills could lead to explosions and fires that could spread to nearby reservoirs and surrounding areas. As the storage tanks are the huge supply of combustible substances, the fire could lead to serious consequences. The aim is to prevent emergencies and the negative impact on the environment in the case of sloshing environmentally hazardous liquids in tanks under the seismic loads action [1-3].

The possibility of vibration damping in the rigid cylindrical tank with the help of the floating cover has been considered. The accelogram data of the earthquake that occurred in 1981 (9 points) in Iran have been taken as horizontal acceleration $a_s(t)$. Note that only the horizontal seismic loads consideration does not violate generality, since the equations structure makes it possible to take into account the vertical component by changing g.



Pic. 1. Accelogram of the Iran earthquake in 1981.

The presence of the floating flexible cover leads to the change in the boundary conditions on the free surface of the liquid. Fig. 2 a) b) shows the oscillation forms of the free surface of the liquid at time t = 2 sec, corresponding to the maximum accelogram amplitude. Fig. 2 a) shows the free surface of the liquid in the absence of the floating cover. Fig. 2 b) shows the liquid surface in the presence of the flexible floating cover [4,5].



a) b)

Pic. 2. Liquid vibrations in the cylindrical tank.

The obtained results show that the floating membrane damps liquid sloshing in the cylindrical tank. The presence of such covers will help to reduce the sloshing amplitude, which, in turn, will reduce the negative environmental consequences concerned with the destruction of tanks with toxic and flammable aggregates. The provided research of the seismic impact on the cylindrical shell with liquid make it possible to create the mathematical model and the effective method for studying the strength and dynamic characteristics of structures under the action of intense impulse and seismic impacts. Proposed methods could increase the environmental safety level of liquid hydrocarbon storage tanks surrounding areas [6-8].

Keywords: seismic loads, environmental safety, storage tanks, liquid sloshing, earthquake.