1.ULUSLARARASI GAZİANTEP BİLİMSEL ARAŞTIRMALAR KONGRESİ

30-31 AĞUSTOS 2024 GAZİANTEP

KONGRE KİTABI

EDİTÖRLER:
Prof. Dr. Mustafa METE
Doç. Dr. Adil AKINCI
Dr. Sc. Gentrit SMAKAJ

www.isarconference.org

IKSAD Publishing House

CONGRESS ID

CONGRESS TITLE

1. INTERNATIONAL GAZİANTEP SCIENTIFIC RESEARCH CONGRESS

DATE AND PLACE

30-31 AUGUST 2024, GAZİANTEP ONLINE PRESENTATIONS

ORGANIZATION

ISARC INTERNATIONAL SCIENCE AND ART RESEARCH CENTER

GENERAL COORDINATOR

Uzm. Yasemin AĞAOĞLU

EDITOR

Prof Dr. Ali ATEŞ
Assoc Prof. Dr. İsmail UKAV
Assist. Prof. Dr. Kaan KOÇALİ

ORGANIZING COMMITTEE

Prof. Dr. Mahire HÜSEYNOVA
Prof. Dr. İbrahim BAYRAMOV
Doç. Dr. Abdulkerim DİLER
Doç. Dr. Ahmet AKKÖSE
Doç. Dr. Elif Feyza TOPDAŞ
Doç. Dr. Gönül SAMEDOVA
Doç. Dr. Malik YILMAZ
Doç. Dr. Nursen IŞIK
Doç. Dr. Özlem ÜLGER DANACI
Doç. Dr. Sahure YARİŞ
Doç. Dr. Tamer TURGUT
Doç. Dr. Volkan ŞENAY
Doç. Dr. Zamıg TEHMEZOV
Dr. Burcu AYDEMİR
Dr. Elvan CAFEROV
Dr. Nazlı KARAMAN
Dr. Nevim TÜZÜN

ISBN: ' 978-625-367-830-2 '

NOTIFICATIONS

RESEARCH OF LIQUID OSCILLATIONS IN COMPLEX TANKS UNDER THE EXTERNAL LOADS EFFECT

Elena Sierikova, PhD
National University of Civil Defence of Ukraine, Kharkiv, Ukraine
ORCID ID: 0000-0003-0354-9720
Elena Strelnikova, Doctor of Technical Sciences
Anatolii Pidhornyi institute of power machines and systems of the National academy of sciences of Ukraine, Kharkiv, Ukraine
ORCID ID: 0000-0003-0707-7214
Kyryl Degtyariov, PhD
Anatolii Pidhornyi institute of power machines and systems of the National academy of sciences of Ukraine, Kharkiv, Ukraine
ORCID ID: 0000-0002-4486-2468
Denys Kriutchenko, PhD
Anatolii Pidhornyi institute of power machines and systems of the National academy of sciences of Ukraine, Kharkiv, Ukraine
ORCID ID: 0000-0002-3837-5567

ABSTRACT

Prismatic tanks are widely used in various branches of modern engineering and construction as tanks, containers, and sluices of hydrotechnical structures. They are also used to store various liquids, such as drinking and fire water, oil, liquefied gas, wine, etc. On large farms, such containers store liquid fertilizers, fuel for agricultural machinery, manure, silage, and so on.

Today, cylindrical containers are the most popular structural solutions for storing oil products, water and other liquids. Since it is the cylinder that is recognized as the most ergonomic and reliable form of container for storing any liquids, cylindrical tanks are used at enterprises of the fuel and energy complex, at enterprises of the light and food industry, are used to store fuel, supplies of food and technical water, including as fire-fighting containers.

In the scientific literature, much less attention has been paid to conical shells in interaction with liquid, despite the wide use of thin-walled conical shells in various fields of technology [1]. In aerospace engineering, such shells were used as fuel tanks in airplanes and satellites. The use of shells in submarines, torpedoes, water-based ballistic missiles and marine drilling rigs of oceanic equipment is known. As far as civil engineering is concerned, conical shells have been used in protective containers in elevated water tanks.

Regular operation, pre-repair and repair work on tanks with environmentally hazardous liquids, as well as their leaks under the influence of seismic loads are a source of technogenic impact on the environment due to emergency situations and threaten the life and health of the population. Therefore, the study of the effect of oscillations and vibrations caused by seismic loads on tanks for storing environmentally hazardous liquids and the assessment of reducing the load on nature is a very relevant scientific and practical issue to improve the environmental safety of the territories adjacent to the tanks [2-4].

In the previous works of the authors [2-4], fluid fluctuations under the action of seismic loads in cylindrical and prismatic tanks have been investigated.

The main objective of this study is to develop a robust numerical approach by combining finite element and boundary element methods to estimate the natural frequencies of oscillations in complex liquid-filled tanks.

The tanks considered in this paper consist of coaxial cylindrical and conical shells connected by rings that form bottoms. The liquid is between the shells.

Note that there are several oscillation frequencies. The corresponding modes of sloshing of the free surface have been shown on Fig. 1 and 2. The flapping frequencies of both structures differ slightly, but they are higher for structures with a smaller radius of the free surface. This difference decreases with increasing wave number. The lowest frequencies correspond to the first, second and third wave numbers. This corresponds to the calculation given in Ibrahim [5] regarding liquid sloshing in conical and cylindrical shells.

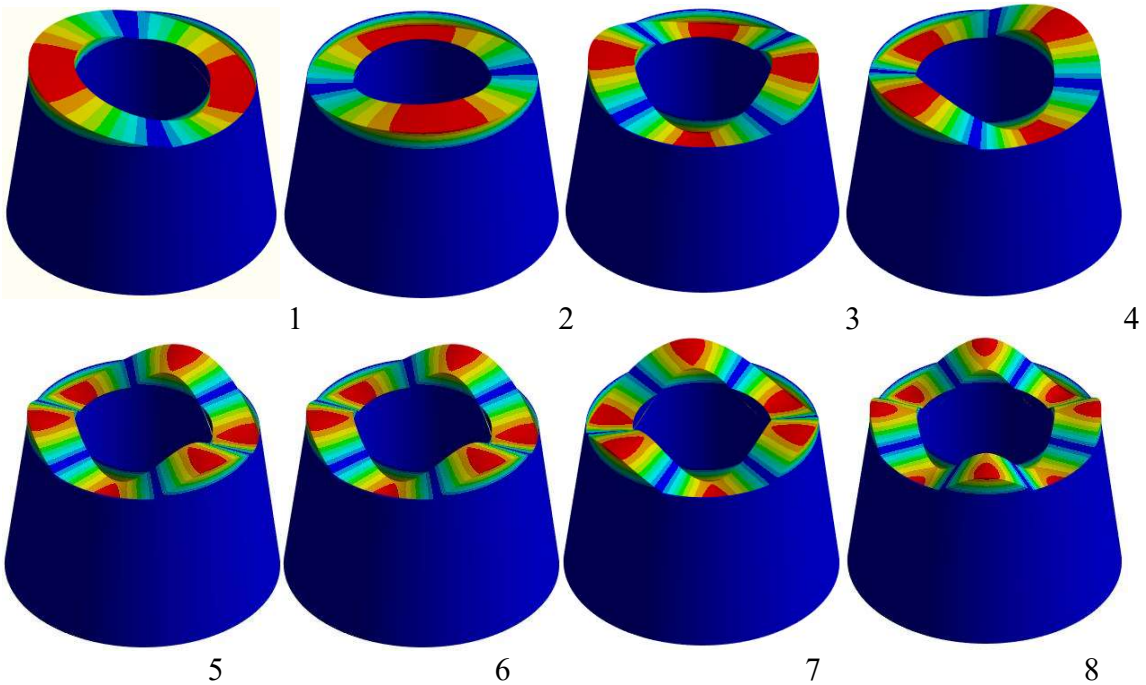

Fig. 1. Sloshing Modes of Structure.

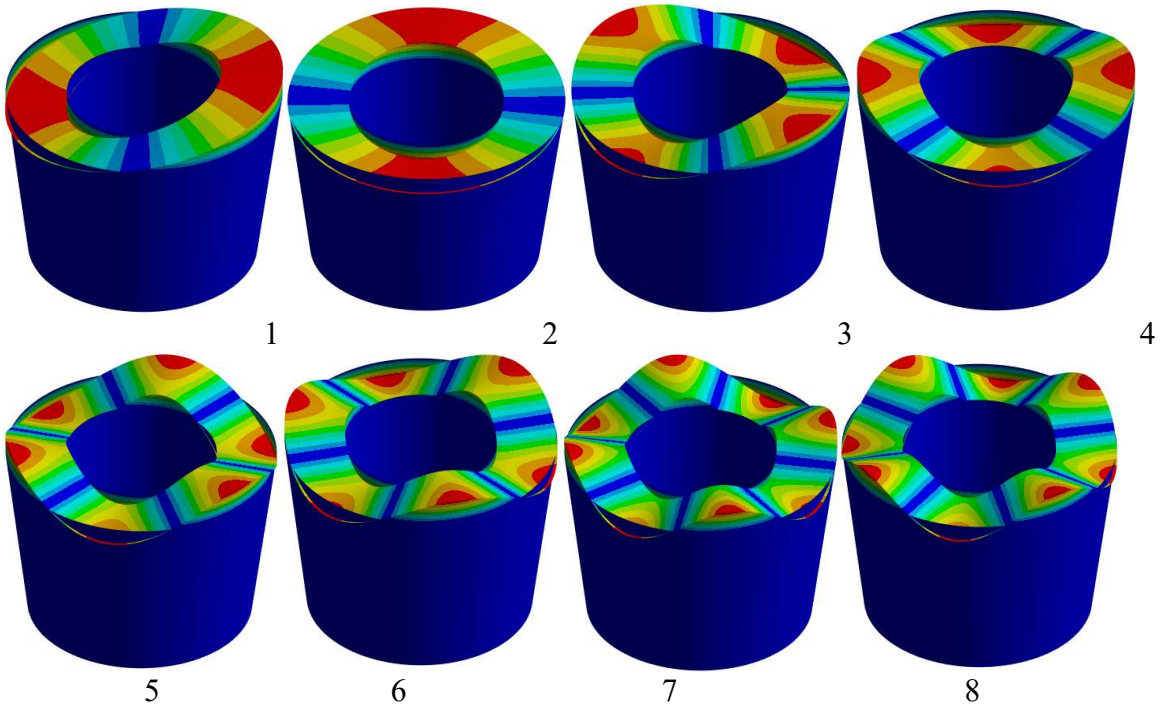

Fig.2. Sloshing Modes of Structure

Thus, the spectral problem to determine the frequencies and modes of fluid oscillations in coaxial shell structures has been solved. This makes it possible to study the movement of liquid in fuel tanks and reservoirs under the influence of external loads [6,7].

REFERENCES:

1. Sierikova O., Strelnikova E., Kriutchenko D., Degtyarev K., Gnitko V., Doroshenko V. 2023. Aeolian Liquid Vibrations in Conical Tanks with Baffles under Wind Loading with Fuzzy Parameters. WSEAS Transactions on Fluid Mechanics. 18:295-300. doi: 10.37394/232013.2023.18.28
2. Sierikova O., Strelnikova E., Kriutchenko D., Gnitko V. 2022. Reducing Environmental Hazards of Prismatic Storage Tanks under Vibrations. WSEAS Transactions on Circuits and Systems, Vol. 21. P. 249-257. DOI: 10.37394/23201.2022.21.27
3. Sierikova O., Strelnikova E., Degtyarev K. 2022. Srength Characteristics of Liquid Storage Tanks with Nanocomposites as Reservoir Materials. 2022 IEEE 3rd KhPI Week on Advanced Technology (KhPIWeek). P. 151-157. **DOI:** 10.1109/KhPIWeek57572.2022.9916369
4. Sierikova O., Strelnikova E., Degtyarev K. 2022. Seismic Loads Influence Treatment on the Liquid Hydrocarbon Storage Tanks Made of Nanocomposite Materials. WSEAS Transactions on Applied and Theoretical Mechanics. vol. 17. P. 62-70. DOI: 10.37394/232011.2022.17.9
5. Ibrahim, R. A. 2005. Liquid Sloshing Dynamics. Theory and Applications. Cambridge University Press. 984 p.
6. Sierikova, O., Strelnikova, E., Gnitko, V., Degtyarev, K. 2021. Boundary Calculation Models for ElasticProperties Clarification of Three-dimensional Nanocomposites Based on the Combination of Finite and Boundary Element Methods. IEEE 2nd KhPI Week on Advanced Technology (KhPIWeek) 351–356. doi: 10.1109/KhPIWeek53812.2021.9570086
7. Sierikova O. The Fundamentals of Boundary Element Methods. 2024. NY: Nova Science Publishers, Inc. 150 p. https://doi.org/10.52305/KFFP5657