

# Static and Hydrodynamic Study of Tanks From Theory to Application Using Simplified Method and Shell Theory

**Mourad Belgasmia**

 <https://orcid.org/0000-0003-0224-3658>

*University of Setif 1, Algeria*

## INTRODUCTION

Shell theory is well suited to better understanding the behavior of a tank. The shells of revolution, represented by their average surfaces (sphere, spherical cap (cover), cone, truncated cone, cylinder, paraboloid, hyperboloid, etc.) are widely used in the construction of civil engineering (tank, water towers, silos, chimneys, TV towers, reactor enclosures, tunnels, galleries, penstocks, cooling towers, covers, foundations, etc.). They also find many applications (tanks, pressure vessels, boilers, pipes, bottles, aircraft fuselages (hulls), rockets, submarine hulls, etc.) in other very varied fields of the engineering (mechanical, aeronautical, hydraulic, shipbuilding, offshore, chemical, purification, etc.).

The membrane theory gives, for the shells of revolution, easy results to obtain, and good values for the cases of loading of revolution, which is frequent in practice.

Several studies have been made for the calculation of structures containing a liquid, namely the water tower and tank, some are in static domain (Rugonyi et al., 2001) other are in dynamic one (Sezena et al., 2008; Zhou et al., 2009), for different shape, rectangular (Chen et al., 2008; Cheng et al., 2009; Ghaemmaghami et al., 2010), and circular (Khouri et al., 2012).

A Tank is a capacity intended to contain a liquid. It can be placed, partially or totally buried on the ground. A tower, walls or columns can also raise it.

Raised structures for water storage, are usually referred to as water towers. There are three types of tanks: - Buried, Semi-buried,- Elevated or water tower.

These tanks can be built uncovered or, on the contrary, provided with a domed or flat slab cover. Tanks can be simple or complex and formed from several superposed cells.

The plan shape can be any. However, most of the time, small tanks are square or rectangular, but the circular shape is less expensive. When the means of execution allow it, tapered and cylindrical-truncated tank are produced instead of cylindrical one for large volume.

In this chapter, we focus on static analysis using two approaches, one with simplified formulas, the other using shell theory. Another part of the chapter is devoted to hydrodynamic analysis using Houzner's method.

DOI: 10.4018/978-1-6684-7366-5.ch010

*This article, published as an Open Access article in the gold Open Access encyclopedia, Encyclopedia of Information Science and Technology, Sixth Edition, is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and production in any medium, provided the author of the original work and original publication source are properly credited.*

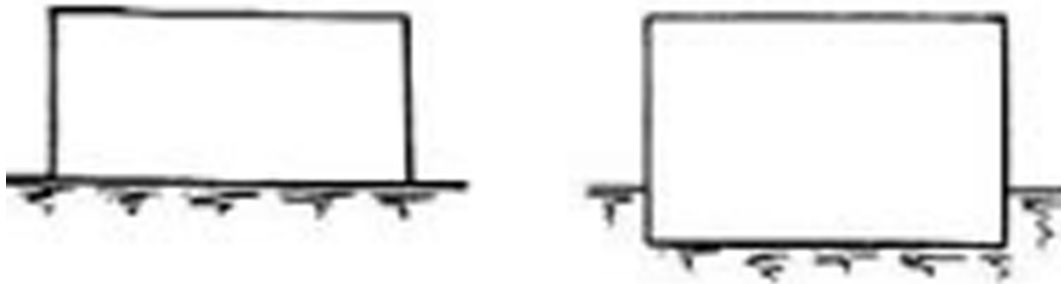
## TANK CLASSIFICATION

Tanks can be classified according to:

Position of the tank relative to the ground

- At ground level (or very slightly buried see figure 1), the tank slab is always placed in contact with the ground on lean concrete 5 to 10 cm thick.

*Figure 1. Tank at ground level and very little buried*



- On columns (slightly raised figure 2) this is the case for swimming pools

*Figure 2. Tank slightly raised*



50 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:  
[www.igi-global.com/chapter/static-and-hydrodynamic-study-of-tanks-from-theory-to-application-using-simplified-method-and-shell-theory/317422](http://www.igi-global.com/chapter/static-and-hydrodynamic-study-of-tanks-from-theory-to-application-using-simplified-method-and-shell-theory/317422)

## Related Content

---

### **A Systematic Review of the Adoption of Blockchain for Supply Chain Processes**

Bongisizwe Erasmus Buthelezi, Patrick Ndayizigamiye, Hossana Twinomurinziand Shope M. Dube (2022). *Journal of Global Information Management* (pp. 1-32).

[www.irma-international.org/article/a-systematic-review-of-the-adoption-of-blockchain-for-supply-chain-processes/297625](http://www.irma-international.org/article/a-systematic-review-of-the-adoption-of-blockchain-for-supply-chain-processes/297625)

### **The Place of ICT in Global Planning**

Abel Usoro (2002). *Advanced Topics in Global Information Management, Volume 1* (pp. 136-149).

[www.irma-international.org/chapter/place-ict-global-planning/4494](http://www.irma-international.org/chapter/place-ict-global-planning/4494)

### **Text Mining-Based Study on Consumer Satisfaction in the Mobile Phone Market**

Qun Zhou, Meihua Chen, Junying Chen, Keren Chenand Sang-Bing Tsai (2024). *Journal of Global Information Management* (pp. 1-20).

[www.irma-international.org/article/text-mining-based-study-on-consumer-satisfaction-in-the-mobile-phone-market/344835](http://www.irma-international.org/article/text-mining-based-study-on-consumer-satisfaction-in-the-mobile-phone-market/344835)

### **The Effects of Strategic Alliance Membership on the Disadvantages of Electronic Commerce Adoption: A Comparative Study of Swedish and Australian Regional Small Businesses**

Robert C. MacGregorand Lejla Vrazalic (2005). *Journal of Global Information Management* (pp. 1-19).

[www.irma-international.org/article/effects-strategic-alliance-membership-disadvantages/3625](http://www.irma-international.org/article/effects-strategic-alliance-membership-disadvantages/3625)

### **The New Realities of Online Trading in the New Global Marketplace**

Bridget Allgood (2002). *Advanced Topics in Global Information Management, Volume 1* (pp. 63-73).

[www.irma-international.org/chapter/new-realities-online-trading-new/4489](http://www.irma-international.org/chapter/new-realities-online-trading-new/4489)