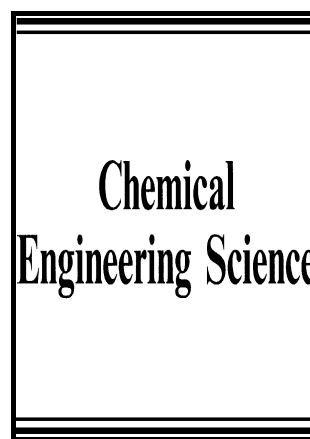


## Author's Accepted Manuscript

An analytical relation for the void fraction distribution in a fully developed bubbly flow in a vertical pipe

O. Marfaing, M. Guingo, J. Laviéville, G. Bois, N. Méchitoua, N. Méricoux, S. Mimouni



[www.elsevier.com/locate/ces](http://www.elsevier.com/locate/ces)

PII: S0009-2509(16)30337-2  
DOI: <http://dx.doi.org/10.1016/j.ces.2016.06.041>  
Reference: CES13021

To appear in: *Chemical Engineering Science*

Received date: 8 April 2016  
Revised date: 15 June 2016  
Accepted date: 17 June 2016

Cite this article as: O. Marfaing, M. Guingo, J. Laviéville, G. Bois, N. Méchitoua, N. Méricoux and S. Mimouni, An analytical relation for the void fraction distribution in a fully developed bubbly flow in a vertical pipe, *Chemical Engineering Science*, <http://dx.doi.org/10.1016/j.ces.2016.06.041>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# An analytical relation for the void fraction distribution in a fully developed bubbly flow in a vertical pipe

O. Marfaing<sup>a\*</sup>, M. Guingo<sup>b</sup>, J. Laviéville<sup>b</sup>, G. Bois<sup>a</sup>, N. Méchitoua<sup>b</sup>, N. Mérigoux<sup>b</sup>, S. Mimouni<sup>b</sup>

<sup>a</sup>Den-Service de thermo-hydraulique et de mécanique des fluides (STMF), CEA, Université Paris-Saclay, F-91191, Gif-sur-Yvette, France

<sup>b</sup>Electricité de France R&D Division, 6 Quai Watier, F-78400 Chatou, France

\*Corresponding author. olivier.marfaing@cea.fr

## Summary

The problem of a steady, axisymmetric, fully developed adiabatic bubbly flow in a vertical pipe is studied analytically with the two-fluid model. The exchange of momentum between the phases is described as the sum of drag, lift, wall and dispersion contributions, with constant coefficients.

Under these conditions, we are able to express analytically the void fraction profile as a function of the liquid velocity and pressure profiles. This relation is valid independently of the Reynolds stress model in the liquid phase – and can serve as a verification case for multiphase flow codes.

The analytical void fraction profile vanishes at the wall, as a result of the balance between dispersion and wall forces. It presents a peak near the wall for upward flows, whereas its maximum is reached in the center of the pipe for downward flows. This is illustrated by calculations performed for upward and downward bubbly flows with the NEPTUNE\_CFD code.

Keywords: two-fluid model, analytical relation, verification, wall force, lift force, dispersion force, drag force, NEPTUNE\_CFD

## Notations

$B$  constant in equation (22), determined from the knowledge of the average void fraction over a cross-section

$C_D$  drag coefficient

$C_L$  lift coefficient

$C_{W1}$ ,  $C_{W2}$  wall coefficients

Download English Version:

<https://daneshyari.com/en/article/6589095>

Download Persian Version:

<https://daneshyari.com/article/6589095>

[Daneshyari.com](https://daneshyari.com)