Pergamon

Int. J. Heat Mass Transfer. Vol. 38, No. 2, p. 391, 1995
Elsevier Science Ltd
Printed in Great Britain

BOOK REVIEW

S. V. ALEKSEENKO, V. E. NAKORYAKOV and B. G. POKUSAEV, **Wave Flow of Liquid Films**. All-Rusian Inc. "Nauka", Novosibirsk, 1992, 256 pp.

The present book is dedicated to wave creation and heat–mass transfer in liquid film flows. It reviews 256 scientific papers (150 of them in English). The authors' interests are in the methods for local measurement of hydrodynamic parameters of films, the theoretical models of wave flows, different types of waves, and their influence on the heat and mass transfer process. A considerable part of this research represents the theoretical and experimental results (more then 30 scientific reports) published by Acad. V. E. Nakoryakov and his colleagues in Novosibirsk.

This book has 14 sections, and contains 12 tables, 163 figures and 277 references.

Section 1 is written as an introduction, where the basic concepts, types of waves, dimensionless parameters of the wave flow of falling films, the region of practical usage of the wave flow, and types of hydrodynamic regime are reviewed.

Section 2 provides a view of the experimental instrumentation for research or hydrodynamics, and heat and mass transfer in films flowing down vertical and inclined surfaces.

Section 3 shows the methods for local measurement of hydrodynamic parameters. Methods for the measurement of local film thickness (by touching the surface, using a radioactive substance, fluorescent substance or solid–koloid particle admixtures, measurement of light absorption or corpuscular ray method—gamma-beams, measurement of the resistance or the capacity of a layer, the interferometer method) are described. A number of methods for the measurement of the local velocity in the film (by a storage container, a pneumatic metric pipe, a thermometer, moving with a microscope, a laser-Doppler anemometer, photographic methods) are also discussed. The local values of the shear stress are determined by a floating element, a heating element, measurement of the velocity profiles, and an electrodiffusion method.

Section 4 draws the reader's attention to the momentum transfer equations. The basic equations and the momentum equation are mentioned.

Section 5 throws light on the hydrodynamics of laminar and turbulent films. The experimental and theoretical results for stationary laminar and turbulent film flow on a smooth plane, flow in the initial region or on surfaces like a cone, cylinder or sphere, as well as non-stationary flow, are described.

Section 6 reviews models of wave flow in the cases of capillary–gravitational waves (dispersion modes, short and long waves) and kinematic waves. Different types of instability are reviewed (Orr–Sommerfeld, Reyleigh–Taylor, Kelvin–Helmholtz). The equations for long two-dimensional waves, long three-dimensional weak non-linear waves at low and medium values of the Reynolds number, and stationary waves are described. The two-wave equation for vertical and inclined film is derived.

Section 7 describes waves in the region of their rise. A number of theoretical and experimental results are presented to the reader.

Section 8 studies two-dimensional periodical stationary waves. The problems connected with the theoretical and experimental research of natural and unnatural stirred waves and instantaneous velocity profiles are taken into consideration.

Section 9 provides the reader with a clear look at the study of solitary waves as a result of stage and local disturbances.

Section 10 considers three-dimensional waves. Progressive and standing waves are studied (experimental instrumentation, dispersion and shape of the crest of three-dimensional standing waves).

Statistical characteristics of wavy and turbulent liquid film flows are shown in Section 11.

The hydrodynamic stability and rise of waves at the liquid film flow–liquid phase boundary are treated theoretically and experimentally in Section 12.

Section 13 shows the influence of waves on heat and mass transfer processes in the cases of intensive interphase mass transfer between a liquid film and a gas (solid surface). Heat transfer in liquid film flow in the cases of non-isothermal absorption and heat exchange with a solid surface, evaporation and condensation are also demonstrated.

Section 14 is devoted to the forming of a film flow at the point of meeting between a liquid stream and a solid baffle. The theoretical and experimental results obtained for hydrodynamics and mass transfer of axisymmetrical film flow are reviewed.

This book is important first, and foremost, because of the wide range of scientific results shown, but also because of the information included in it. This book is geared to engineers, scientists and students in the domains of thermophysics, hydromechanics and chemical technology.

CHR. BOYADJIEV
Institute of Chemical Engineering
Bulgarian Academy of Sciences
1113 *Sofia, Bulgaria*