$$T_3 = -A_\delta W_3 \rho_l \frac{V_{f0}^2}{2}\left(1+\frac{Q_g}{Q_l}\right)\left(\frac{\xi^2}{\xi^2-1}\right)^2 \tag{A7}$$

$$T_4 = -A_0 \bar{E}_l^{-z} \lambda_0 \frac{1}{D} \rho_l \frac{V_{f0}^2}{2} \tag{A8}$$

Inserting these quantities into Eq (A1) and neglecting[7] the term expressing the rate of momentum change, gives, after some manipulation, the dimensionless equation:

$$\beta - \bar{E}_l = \frac{V_{f0}^2}{2gl}(\sigma_1 + \sigma_2 + \sigma_3) \tag{A9}$$

where:

$\sigma_1 = \bar{E}_l^{1.7} \lambda_0 (l/D)$ (losses in the riser[9])

$\sigma_2 = W_3\left(1+\frac{Q_g}{Q_l}\right)\frac{\xi^2}{\xi^2-1}$ (losses in the injector)

$\sigma_3 = \lambda_\delta \frac{t_s}{D-d}\left(\frac{\xi^2}{\xi^2-1}\right)^2$ (losses in the suction pipe)

In these expressions the average liquid holdup $\bar{E}_l$ is given[3,4] by:

$$\bar{E}_l = 1 - \bar{E}_g = \frac{V_{f0} + 0.345(gD)^{1/2}}{V_{f0}(1 + Q_g/Q_l) + 0.345(gD)^{1/2}} \tag{A10}$$

and the friction factors λ_0, λ_δ by:

$\lambda_0 = \frac{64}{Re}$ for $Re_{f0} < 2500$

$\lambda_0 = \frac{0.316}{Re^{0.25}}$ for $Re > 3500$

$\lambda_\delta = \Phi\lambda_0$ for annular section and[11] $Re_{f\delta} < 2500$

The coefficient W_3 in Eq (A7) has been correlated on the basis of our measurements due to lack of appropriate expressions for this coefficient.

To calculate the liquid flow rate Q_l (in the present case the water flow rate Q_w) contained in Eq (A2), the latter has been solved numerically using the Regula-Falshi method[13].

BOOK REVIEW

Forum on Unsteady Flow

Ed P. H. Rothe

This booklet documents the first of an anticipated series of forums on unsteady flow sponsored by the Fluid Transients Committee of the ASME Fluids Engineering Division. These forms mimic a highly successful series on cavitation sponsored by the Multiphase Flow and the Fluid Machinery Committees of the same Division, in which the opportunity is provided to present and discuss the current status of research projects before they are mature enough for publication in archival journals. As a result, this booklet is a collection of brief papers without in-depth introductions or, in many cases, complete conclusions.

Seventeen papers are organized into three major topics: I. Devices and systems affected by unsteady flow; II. Unsteady flow in piping: III. Basic studies and reviews of unsteady flows. The six papers in the first topic address such diverse devices and systems as wave rotors, MHD channel flow, wing/plate junction flow, propellant sloshing, and water hammer. Several papers describe analytical studies while others are experimental.

The six papers in the area of unsteady flow in piping represent the largest number addressing a single unsteady flow topic. Included is a diversity of piping related problems from a 'Case of feedwater piping vibration' to the analysis of the unsteady flow of non-Newtonian fluids and a Bingham plastic. Topic III includes three papers concerning unsteady convective heat transfer. One of these entitled 'Convective heat transfer enhancement in unsteady channel flow—a review', not only provides a good introduction to the subject, but also an extensive bibliography.

Although the papers are brief and diverse, the booklet serves to introduce some current research problems in unsteady flow. It is hoped that this sort of forum will expand in the future and provide the thermal sciences community with a valuable insight to the complex phenomena associated with unsteady flows. The efforts of the Editor and authors are applauded.

R. E. Henderson
Garfield Thomas Water Tunnel,
The Pennsylvania State University,
USA

Published, price $18.00, by ASME, 345 East 47th Street, New York, NY 10017, USA. (ASME code FED—vol. 16)