BOOK REVIEWS

Pressure Surges

This conference proceedings of a meeting held in Bath in September 1983 undoubtedly represents a major contribution to the rapidly developing field of unsteady flow analysis, and in particular the associated numerical methods in the context of hydraulic systems.

The conference was divided into ten sessions, reflecting a wide range of interests, from theoretical pulsating flow studies through numerical methods (two sessions), particular system or component studies—cavitation, surge control, fluid-structure interaction, check valves, hydroelectric installations—to specific case studies. A substantial number of papers deal with applications of the method of characteristics and associated numerical solution techniques to simple or branched pipe systems, taking into account friction, wall elasticity and junction properties. Particular attention is paid to stability and rapid convergence (Vardy and Lin Chan—'Rapidly attenuated water and steel hammer'; Wylie—'Advances in use of MOC in unsteady pipeline flow'). Liou's paper, 'Calculations of transients in batched pipelines', introduces a new procedure eliminating interpolations and the associated 'smearing' of wave fronts, with particular reference to batched pipe sections where changes in properties associated with changes in section are more significant than changes associated, within one batch, with pressure and temperature variations. Shuy and Apelt, 'Friction effects in unsteady pipe flows', deal very thoroughly with the modelling of friction for unsteady laminar and turbulent flow, including a useful survey of existing formulations.

The more applied sections, eg 'Surge control and safety measures' (Session C), 'Fluid structure interaction' (Session E), 'Check valves' (Session F), 'Hydroelectric installations' (Sessions G and H) contain a number of very detailed and well presented papers. These include Shimada and Okushima ('A viscous solution for valve stroking to control waterhammer') and Guney ('Waterhammer in viscoelastic pipes where cross-section parameters are time dependent'). Various papers on dynamic behaviour of check valves (Session F) deal in commendable detail with pipe system, valve interaction and give interesting comparisons with recorded events. Similar remarks apply to the papers on hydroelectric installations (Sessions G and H) where such problems as the varying boundary conditions for reversible pump turbines and the dynamic characterization of governed turbogenerator sets are dealt with by appropriate special techniques. Chapman and Robbie, 'Eigenvalue stability analysis of surge systems involving double vented shafts—theory and practice', present an interesting lumped parameter dynamic analysis and, in an appendix, a systematic presentation of 'tee' junction losses under various flow regimes.

In summary, the conference papers represent a substantial contribution to the deeper understanding of the behaviour of complex hydraulic systems and are clearly required reading for specialists in the field.

F. J. Wallace
University of Bath, UK

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Convection in Liquids

J. K. Platten and J. C. Legros

The book is divided into four sub-sections. The first introduces the basic conservation equations used to describe momentum and energy transport in fluids. Principles of linear stability analysis are introduced and the resulting governing equations are derived. An introduction to variational calculus and finite difference techniques which are useful in the solution of stability problems concludes this section.

Application of linear stability analysis to constant density flow in ducts is treated in the second section. The use of several different methods, including finite difference methods, with the variational presentation of the Orr–Sommerfeld equation for Poiseuille and Couette flows in both Cartesian and cylindrical coordinates, is described. Flow stabilities in non-Newtonian fluids are also discussed.

The third section deals with a non-isothermal, one component system. Both linear and non-linear theory applied to the Bernard problem are presented. The influence on stability of temperature gradients due to viscous heating or imposed by the boundary conditions is discussed. The section concludes with an analysis of mixed convection flows. The final sub-section deals with free and mixed convection in multicomponent systems.

The authors do a masterful job in discussing a very complicated subject. The text is well written and easy to follow. Numerous examples of the application of the techniques are presented to outline clearly for the reader the steps needed to obtain information on flow instabilities. As an added feature, descriptions of simple experiments which can be conducted to verify the calculations for the Bernard problem are presented.

F. W. Schmidt

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