

Air Bubble Entrainment in Free-Surface Turbulent Shear Flows

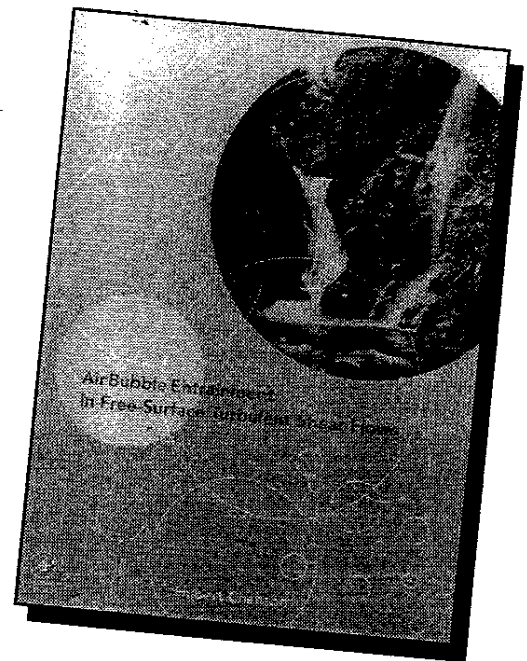
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This book develops an analysis of the air entrainment processes in free-surface flows. These flows are investigated as homogeneous mixtures with variable density. The variations of fluid density are caused by the non-uniform air bubble distributions and result from a turbulent diffusion process. Several types of air-water free-surface flows are studied: plunging jet flows, open channel flows, and water jets discharging into air. Each configuration can be characterised as a high-velocity free-surface flow with turbulent shear layers and large air bubble contents. Experimental observations confirm the concept that the air-water mixture behaves as a homogeneous compressible fluid in each case.

CONTENTS

PART I: Introduction: Mechanisms of Air Bubble Entrainment – Similitude and Experimental Studies – Air-Water Gas Transfer. PART II: Plunging Jet Flows: Presentation – Air Entrainment by Plunging Jets – Air Entrainment in Hydraulic Jumps – Air Entrainment in Plunging Jet Flows: Related Cases and Gas Transfer. PART III: Self-Aerated Open Channel Flows: Self-Aerated Flows – Presentation – Air Entrainment in Steep Chute Flows – Air Entrainment in Small-Slope Waterways – Air Entrainment in Partially-filled Conduits – Air Entrainment in Open Channels: Discussion. PART IV: High-Velocity Water Jets and Related Air-Water Flows: Introduction to High-Velocity Water Jets Discharging into the Atmosphere – Air Entrainment in High-Velocity Water Jets – Ventilated Cavity Flows – Spillway Application: Aeration Devices. Part V: Summary and Conclusion: Summary: Air Bubble Diffusion in Shear Flows.



KEY FEATURES

- New information on the air-water flow field: air bubble distributions, air-water velocity profiles, air bubble sizes and bubble-turbulence interactions.
- New analysis is developed for each flow configuration and compared successfully with model and prototype data.
- Includes over 372 references and more than 170 figures with over 60 photographs.
- Presents useful information for design engineers and research-and-development scientists who require a better understanding of the fluid mechanics of air-water flows.

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