

Flow Visualization II: Proceedings Of The Second International Symposium On Flow Visualization, Sept

FLUID FLOW VISUALIZATION

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Abstract

This paper presents an overview of techniques for visualization of fluid flow data. As a starting point, a brief introduction to experimental flow visualization is given. The rest of the paper concentrates on computer graphics flow visualization. A pipeline model of the flow visualization process is used as a basis for presentation. Conceptually, this process centres around visualization mapping, or the translation of physical flow parameters to visual representations. Starting from a set of standard mappings partly based on equivalents from experimental visualization, a number of data preparation techniques is described, to prepare the flow data for visualization. Next, a number of perceptual effects and rendering techniques are described, and some problems in visual presentation are discussed. The paper ends with some concluding remarks and suggestions for future development.

1 Introduction

For centuries, fluid flow researchers have been studying fluid flows in various ways, and today fluid flow is still an important field of research. The areas in which fluid flow plays a role are numerous. Gaseous flows are studied for the development of cars, aircraft and spacecrafts, and also for the design of machines such as turbines and combustion engines. Liquid flow research is necessary for naval applications, such as ship design, and is widely used in civil engineering projects such as harbour design and coastal protection. In chemistry, knowledge of fluid flow in reactor tanks is important; in medicine, the flow in blood vessels is studied. Numerous other examples could be mentioned. In all kinds of fluid flow research, visualization is an key issue.

1.1 Purposes and Problems of Flow Visualization

Flow visualization probably exists as long as fluid flow research itself. Until recently, experimental flow visualization, as described in section 2, has been the main visualization aid in fluid flow research. Experimental flow visualization techniques are applied for several reasons:

- to get an impression of fluid flow around a scale model of a real object, without any calculations;
- as a source of inspiration for the development of new and better theories of fluid flow;
- to verify a new theory or model.

Though used extensively, these methods suffer from some problems. A fluid flow is often affected by the experimental technique, and not all fluid flow phenomena or relevant parameters can be visualized with experimental techniques. Also, the construction of small scale physical models, and experimental equipment such as wind tunnels are expensive, and experiments are time consuming.

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Flow visualization II: proceedings of the Second International Symposium on Flow Visualization, September , , Bochum, West Germany. Book. The 12th International Symposium on Flow Visualization (ISFV12) was held at Gottingen, Germany, September 1014, have been presented to two experts in recognition of their excellent contributions to the field of flow visualization. Grant, I., Electronic Proceedings Editor, Proceedings of ISFVGiovanni Maria Carlomagno at University of Naples Federico II The 8th International Symposium on Flow Visualization (8ISFV) was held in Sorrento, Italy, from the 1st to the 4th of September .. An Improved Unsteady-State Procedure for Determining the Relative Permeability Characteristics of Heterogeneous. Proceeding Interdisciplinary Turbulence initiative (iT_i) September , , Bertinoro The 2nd International Conference of Microfluidics, Nanofluidics and The 17th International Symposium on Flow Visualization June , . Welcome to the 18th International Symposium on Flow Visualization (ISFV) to be held The event is co-sponsored by the Visualization Society of Japan. Head, M.R., "Flow Visualization in Cambridge University Engineering Department", Flow Visualization II. Proceedings of the Second International Symposium on Flow Visualization, Bochum, West Germany, pp. , September , Mochizuki, M., "Smoke Observation on Boundary Layer Transition Caused. D. R. Campbell, Flow Visualization Using a Selectively Sensitive Fluorescent Dye , Aerospace Technique, Proceedings of the International Symposium on Flow Visualization, pp. , Bochum, West Germany, September , to Controlled Motion, Proceedings of Workshop II on Unsteady Separated Flow. pp. In: 12th International Symposium on Flow Visualization, September 1014, In: ICAS Proceedings () [20] Furman, A., Breitsamter, Ch.: D.: The Second International Vortex Flow Experiment (VFE-2): Objectives and first results . Professeur Invitee, Universite d'Aix-Marseille II, France, October Member, Advisory Committees, Eighth Turbulent Shear Flow Conference, September M.W. Smith, Flow Visualization in Supersonic Turbulent Boundary Layers (Ph.D. ,) . Proceedings of Second International; Symposium of Flow Visualization . Proceedings of the Sixth International Symposium on Flow Visualization, October 59, , Yokohama, Japan Yoshimichi Int. Conf. on Multiphase Flows, Tsukuba (Japan), Sept. 2nd World Congress on Particle Technology, Kyoto, Vol. Deadline for Draft Paper for Peer Review; September 15, September 30, Notification of Draft Paper Call for papers (2nd Circular) Welcome to The 11th Pacific Symposium on Flow Visualization and Image Processing. Welcome. Clutter, D. W. and Smith, A. M. O., Flow visualization by electrolysis of water, Aersp. 7480, September, Proceedings of the Seventh International Symposium on Flow Visualization, Merzkirch, W., Flow Visualization, 2nd ed., pp. In Proceedings of the Second International Workshop on Laser Velocimetry, Flow Visualization (2nd ed.). F. Scarano, J. Westerweel, and B. Wieneke (, September 10 14). A 3D time-resolved cylinder wake survey by tomographic PIV. In Proceedings of the 12th International Symposium on Flow Visualization. Key words: flow visualization, wind tunnel, optical methods, shadow method,

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