

The Quantitative Density Measurement of Unsteady Flow around the Projectile*

Yusuke Hirose¹, Kazuki Ishikawa¹, Yoshiyuki Ishimoto¹, Takumi Nagashima¹, Masanori Ota¹, Shinsuke Udagawa², Tatsuro Inage³, Kazuki Fujita³, Hidetoki Kiritani⁴, Koji Fujita⁴, Kiyono bu Ohtani⁴, Hiroaki Nagai⁴

¹Graduate School of Engineering, Chiba University, Chiba, Japan

²Aerospace Engineering Course, Tokyo Metropolitan College of Industrial Technology, Tokyo, Japan

³Department of Mechanical Engineering, Shonan Institute of Technology, Fujisawa, Kanagawa, Japan

⁴Institute of Fluid Science, Tohoku University, Sendai, Miyagi, Japan

Email: yusuke@faculty.chiba-u.jp

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Abstract

Three-dimensional density measurement of unsteady flow field around a sphere is carried out in the ballistic range at Institute of Fluid Science, Tohoku University. Simultaneous multi-angle measurement system using twelve digital cameras is installed in the test chamber of the ballistic range to achieve the three-dimensional density measurement. The Colored-Grid Background Oriented Schlieren (CGBOS) technique using colored-grid background is utilized for the reconstruction of density. The Mach number of the sphere is set to 1.5. The short pulse LEDs to illuminate the backgrounds are also installed in the chamber to capture the unsteady flow field around a flying sphere. Three-dimensional density distribution around a sphere is successfully reconstructed.

Keywords

Background Oriented Schlieren, Flow Visualization, High Speed Flows, Unsteady Flow, Simultaneous Measurement

1. Introduction

The supersonic aircrafts and rockets are developed actively all over the world. In the development process, the density measurement around the model of aircraft and rockets under the supersonic speed is important in order to obtain aerodynamic properties [1] [2] [3].

*A part of this work was presented at 13th International Conference Fluid Dynamics (ICFD13) in Sendai, 7-9 Nov. 2018.

Symposium On Measurement In Unsteady Flow

Paul W. Eshleman, Robert A. Blase



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Vive la Revolution was the theme of the Twenty Third Symposium on Naval Hydrodynamics held in Val de Reuil France from September 17 22 2000 as more than 140 experts in ship design construction and operation came together to exchange naval research developments The forum encouraged both formal and informal discussion of presented papers and the occasion provides an opportunity for direct communication between international peers This book includes sixty three papers presented at the symposium which was organized jointly by the Office of Naval Research the National Research Council Naval Studies Board and the Bassin d'Essais des Car nes This book includes the ten topical areas discussed at the symposium wave induced motions and loads hydrodynamics in ship design propulsor hydrodynamics and hydroacoustics CFD validation viscous ship hydrodynamics cavitation and bubbly flow wave hydrodynamics wake dynamics shallow water hydrodynamics and fluid dynamics in the naval context **Applied Mechanics Reviews**, 1969 *U.S. Environmental Protection Agency Library System Book Catalog Holdings as of July 1973* United States. Environmental Protection Agency. Library Systems Branch, 1974 Hydraulic Research in the United States, 1963 *Australasian Conference on Hydraulics and Fluid Mechanics*, 1966 **Proceedings of the 34th International Symposium on Shock Waves, Volume 3: Applications 2** Rho Shin Myong, Heuy Dong Kim, 2025-09-03

Shock waves are strong pressure waves of irreversible processes in elastic media such as gas liquid or solid generated by supersonic aircraft explosions or other phenomena that create rapid changes in pressure The ISSW34 proceedings cover theoretical experimental and computational studies of these shock waves and related phenomena both fundamental and applied providing the most up to date information to physicists chemists engineers and applied mathematicians engaged in shock wave research The present three volumes bring the most recent studies on diverse topics such as shock waves in gases and liquids and solids shock waves in internal flows detonation supersonic and hypersonic flows nozzle flows and supersonic jet as well as emerging topics such as advanced shock tube design and utilization recent development in diagnostics and flow

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Symposium On Measurement In Unsteady Flow Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Symposium On Measurement In Unsteady Flow**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound affect our existence.

Throughout this critique, we shall delve in to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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