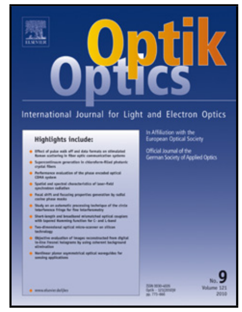
Accepted Manuscript



Title: Numerical investigation of error rates in rough particle sizing using interferometric out-of-focus imaging

Author: Marc Brunel Mohamed Talbi Lila Ouldarbi Sébastien Coëtmellec Gérard Gréhan

PII: S0030-4026(17)30939-7
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2017.08.046
Reference: IJLEO 59509

To appear in:

Received date: 16-6-2016
Revised date: 13-4-2017
Accepted date: 4-8-2017

Numerical investigation of error rates in rough particle sizing using interferometric out-of-focus imaging

Marc Brunel, Mohamed Talbi, Lila Ouldarbi, Sébastien Coëtmellec, Gérard Gréhan

UMR CNRS 6614 CORIA, Normandie University, UNIROUEN, INSA Rouen, 76000 Rouen, France

Abstract

We realize a numerical investigation of error rates in rough particle sizing using interferometric out-of-focus imaging. We show that an automatic image processing based on a 2D-Fourier transform of the patterns allows size estimations with accuracy better than algorithms based on 2D-autocorrelation of the patterns. When ILIDS allows size determination of droplets whose out-of-focus images exhibit 2 or 3 bright fringes, we show that the minimum size measurable in the case irregular rough particles is around two or three times higher than for spherical droplets.

Keywords: Interferometric out-of-focus imaging, speckle, irregular particles

1. Introduction

Interferometric out-of-focus imaging is a robust technique that has important potentiality for the characterization of droplets [1, 2, 3, 4, 5, 6, 8, 7, 9, 10], bubbles [11],and irregular rough particles in a flow [12, 13, 14, 15, 16]. Particles are illuminated by an intense laser beam (generally a laser sheet). An out-of-focus imaging system is used to collect light scattered by the particles. The out-of-focus images of particles exhibit interference fringes whose characteristics depend on the nature and on the size of the scattering particle. In the case of spherical droplets or bubbles, size measurement is based on the analysis of a two-wave interference pattern composed of vertical and parallel fringes. Images can be analyzed using classical light scattering theories

Email address: marc.brunel@coria.fr (Marc Brunel)

Preprint submitted to Optik April 13, 2017