

# QUANTITATIVE VISUALIZATION OF OPEN-AIR SHOCK WAVES BY NATURAL BACKGROUND

T. Mizukaki<sup>1</sup>, K. Wakabayashi, T. Matsumura, and Y. Nakawama<sup>2</sup>

<sup>1</sup>*Tokai University, 4-1-1, Kitakaname, Hiratsuka, Kanagawa 259-1292, Japan;* <sup>2</sup>*Advanced Institute of Science and Technologies, 5, Chyuo, 1-1-1, Higashi, Tsukuba, 305-8565, Japan*

**Key words :** Background-oriented schlieren, Optical tomography, High-speed images, Natural background, Image analysis

This paper describes an application of background-oriented schlieren method to obtain the density distribution of shock waves in open-air explosions. The explosions were recorded with a high-speed digital video camera at frame rate of 10,000 frames-per-second and a 30  $\mu$ s exposure time. Overpressure was also recorded with piezo-type pressure transducers for quantitative comparison. The shock waves were generated by 36 kg of emulsion explosives (EMX). We calculated the refraction angle of the ray from the explosion images and compared the results with those from self-similar solutions and numerical analysis. Both experimental and theoretical results agreed well. Peak overpressure estimated by x-t diagram obtained from visualized images agrees well with the measured results. We expect that this technique may be developed to quantitatively investigate large-scale shock-related open-air phenomena.