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IMAGE FUSION OF DUAL-MODAL TOMOGRAPHY (ELECTRICAL CAPACITANCE AND OPTICAL) FOR SOLID/GAS FLOW

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Abstract. *The paper presents a novel method of combining dual modality electrical capacitance and optical tomography for applications in monitoring and investigating solid/gas flow. The objective of this method is to obtain a good quality image of the full-scale concentration distribution of solid/gas flow. A new image reconstruction algorithm fused the dual modality images is developed and evaluated.*
Keywords: Electrical capacitance tomography, Optical tomography, Dual-modal tomography, Image fusion, Reconstruction algorithm, Solid/gas flow

1. **Introduction.** In recent years, numerous types of tomographic sensors have been designed and evaluated for monitoring and investigating the industrial solid/gas flow. This research was conducted in order to obtain high resolution cross-section images of solid/gas flow for industrial applications. However, though many studies have been conducted in this field, it remains a very difficult problem [1,2].

Several tomographic sensing approaches are among the many techniques that have been tried for producing images of solid/gas flow. These tomographic techniques include electrical capacitance, gamma and optical tomography, which consist of single modality tomography. In previous studies, the utilization of only one tomography modality has been proven incapable of producing high-resolution images throughout the full range of concentration distributions, and has therefore not been adequate for exploring the important flow characteristics [2]. Currently, the new trend in sensor development of solid/gas flow is either through dual or triple modality in one sensor plane. These multimodal techniques overcome the constraints found when only one tomography modality is applied. The advantages and limitations of sensing modalities are shown in Table 1 from numerous previous studies.

Thus, considering the limitations of using only one sensing technique, we propose a new method of combining an electrical capacitance and optical sensor in one sensor plane. The main purpose of this project is to obtain a high resolution image fusion over the full range of concentration distributions by means of a new image reconstruction algorithm. The