Optical tomography system using charge-coupled device for transparent object detection

Juliza Jamaludin*a, Ruzairi Abdul Rahimbc, Mohd Hafiz Fazalul Rahimda, Yasmin Abdul Wahab*e
, Jemmy Mohd Rohanianf, Musab Sahrima, Wan Zakiah Wan Ismaila, Irneza Ismaila, and Sharma
Rao Balakrishnan*a

a Faculty of Engineering and Built Environment, Universiti Sains Islam Malaysia, 71800 Bandar
Baru Nilai, Negeri Sembilan, Malaysia.
b Faculty of Electrical and Electronic Engineering, Universiti Tun Hussien Onn Malaysia, 86400
Parit Raja, Batu Pahat, Johor, Malaysia.
c Process Tomography and Instrumentation Engineering Research Group (PROTOM-i),
Infocomm Research Alliance, Faculty of Electrical Engineering, Universiti Teknologi Malaysia,
81310 UTM Johor Bahru, Johor, Malaysia.
d Tomography Imaging Research Group, School of Mechatronic Engineering, Universiti Malaysia
Perlis, 02600 Arau, Perlis, Malaysia.
e Faculty of Electrical and Electronic Engineering, Universiti Malaysia Pahang, 26600 Pekan,
Pahang
f Jemmy Mohd Rohani Enterprise, No 43, Jalan Merak ½, Bandar Putra, 81000 Kulai, Johor.

ABSTRACT
This research presents an application of Charge-Coupled Device (CCD) linear sensor and laser
diode in an optical tomography system. Optical tomography is a non-invasive and non-intrusive
method of capturing a cross-sectional image of multiphase flow. The measurements are based
on the final light intensity received by the sensor and this approach is limited to detect solid
objects only. The aim of this research is to analyse and demonstrate the capability of laser with
a CCD in an optical tomography system for detecting objects with different clarity in crystal
clear water. Experiments for detecting transparent objects were conducted. The object’s
diameter and image reconstruction can also be observed. As a conclusion, this research has
successfully developed a non-intrusive and non-invasive optical tomography system that can
detect objects in crystal clear water.

KEYWORDS:
Optical tomography system; Charge-Coupled Device; laser diode; image reconstruction