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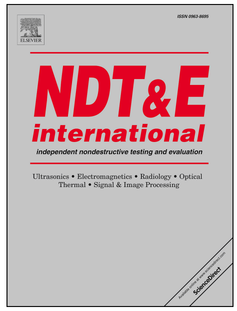

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ACCEPTED MANUSCRIPT

Inline Multi-Material Identification via Dual Energy Radiographic Measurements

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Abstract

In the waste recycling industry, material separation is of key importance. In this paper, we present a new material identification method, based on dual-energy X-ray radiographic images, developed in the context of waste recycling industry. The algorithm is based on a dual energy technique and allows to estimate the effective atomic number of the sample under investigation. A projection simulator with high accuracy that allows to simulate realistic measurements of a wide range of materials is used. The resulting virtual measurements are then used in an identification tool, which achieves the identification by comparing the virtual and actual measurements. Via this procedure, an extensive range of materials and thicknesses can be analyzed and identified. Finally, an optimization scheme has been developed, which allows the selection of an ideal setting for the scanner, in order to optimize the identification process.

Keywords: Dual Energy, Multi-Material Identification, Setup Optimization.

1. Introduction

Material separation is of critical importance for the waste recycling industry. After mechanical separation methods such as sieving, wind sifting, magnetic and eddy current separation, the resulting material streams still contain impurities. Therefore it is common to use sensor technologies, such as near infrared (NIR) [1,2] and color [1] measurements to sort out remaining impurities. However, the major drawback of these technologies is that they only take the surface properties of the materials into account which, in the case of waste, is not representative for the bulk of the particle since the material is often covered by dirt. In addition, surface technologies do not allow for the determination of the mass of particles without making assumptions about the shape of the particles. X-ray transmission (XRT) is a technology which is able to tackle these shortcomings, as it measures the complete material volume. Despite promising earlier results [3], its potential in the waste recycling community has not been fully exploited yet [4,5].

Therefore, the goal of this work is to develop a material identification protocol that can be used to identify a wide range of mono-materials[1] with non-homogeneous density and thickness. The protocol should facilitate a fast and automatic characterization of

[1] Mono-materials are defined here as materials with a single chemical composition.

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