Analysis of Seed Sorting Process by Estimation of Seed Motion Trajectories

Ole Thomsen Buus[1], Johannes Ravn Jørgensen[1], and Jens Michael Carstensen[2]

[1]Aarhus University, Faculty of Agricultural Sciences, Department of Genetics and Biotechnology, 4200 Slagelse, Denmark.
[2]Informatics and Mathematical Modelling, Technical University of Denmark, Building 321, DK-2800 Lyngby, Denmark.

ABSTRACT & INTRO

Seed sorting is a mechanical process in which the goal is to achieve a high level of purity and quality in the final product. Prediction and control of such processes are generally considered very difficult.

One possible solution is a systems identification approach in which the seeds and their movement are directly observed and data about important process parameters extracted.

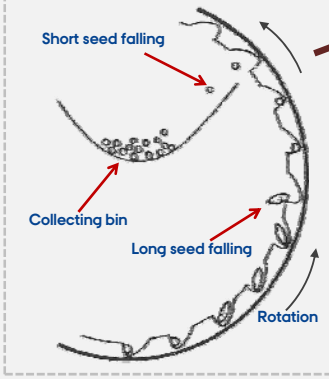
Image analysis was used to extract such data from the internal sorting process in one particular seed sorting device - the so-called "indented cylinder".

Twenty high speed image sequences were recorded of the indented cylinder in action, sorting a batch of barley with both whole and broken kernels.

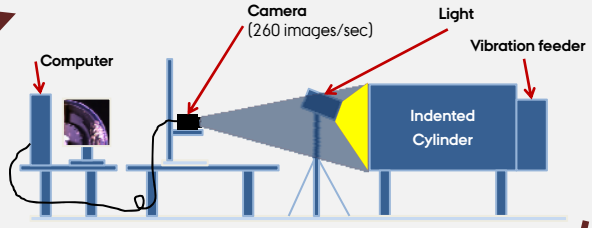
The motion trajectories and angle of escape for each seed in each frame were estimated. Motion trajectories and frequency distributions for the angle of escape are shown for different velocities and pocket sizes.

Materials and Methods

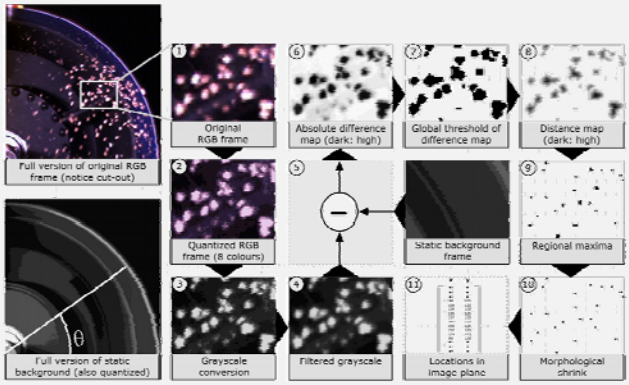
1 The Indented Cylinder



2 Experimental Setup



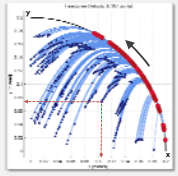
3 Image Processing



4 Trajectory Estimation

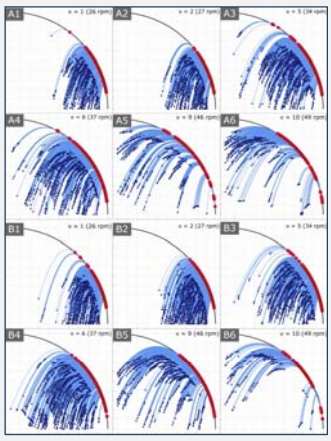
$$y = f(R, \omega, x, \theta)$$

R = radius of cylinder
ω = rotational speed
θ = angle of escape

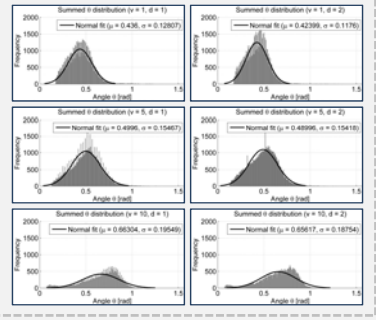


Results

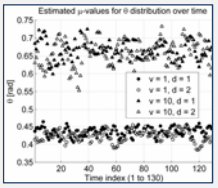
1 Trajectory Plots



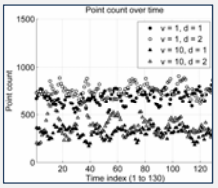
2 "Angle-of-escape" distributions



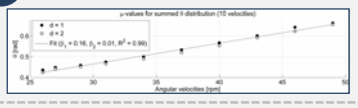
3 Process Stability



4 Algorithm Stability



5 A linearity?



CONCLUSIONS

In this work we have experimentally verified a certain behaviour of the sorting process in the indented cylinder. **First** and foremost we show that the process has some stability (but mostly for the lower velocity steps).

Secondly, we show a linear relation between rotational speed and angle of escape .

A **third** results is a more tentative one: We have shown that image analysis can be used for flow analysis of particles moving in an indented cylinder. This is a novel step toward the goal of predicting and controlling the sorting process in these machines.

Poster paper is available in conference proceedings on pages 273-284.
Presented at the **Scandinavian Conference in Image Analysis 2011** - 23-27 May 2011