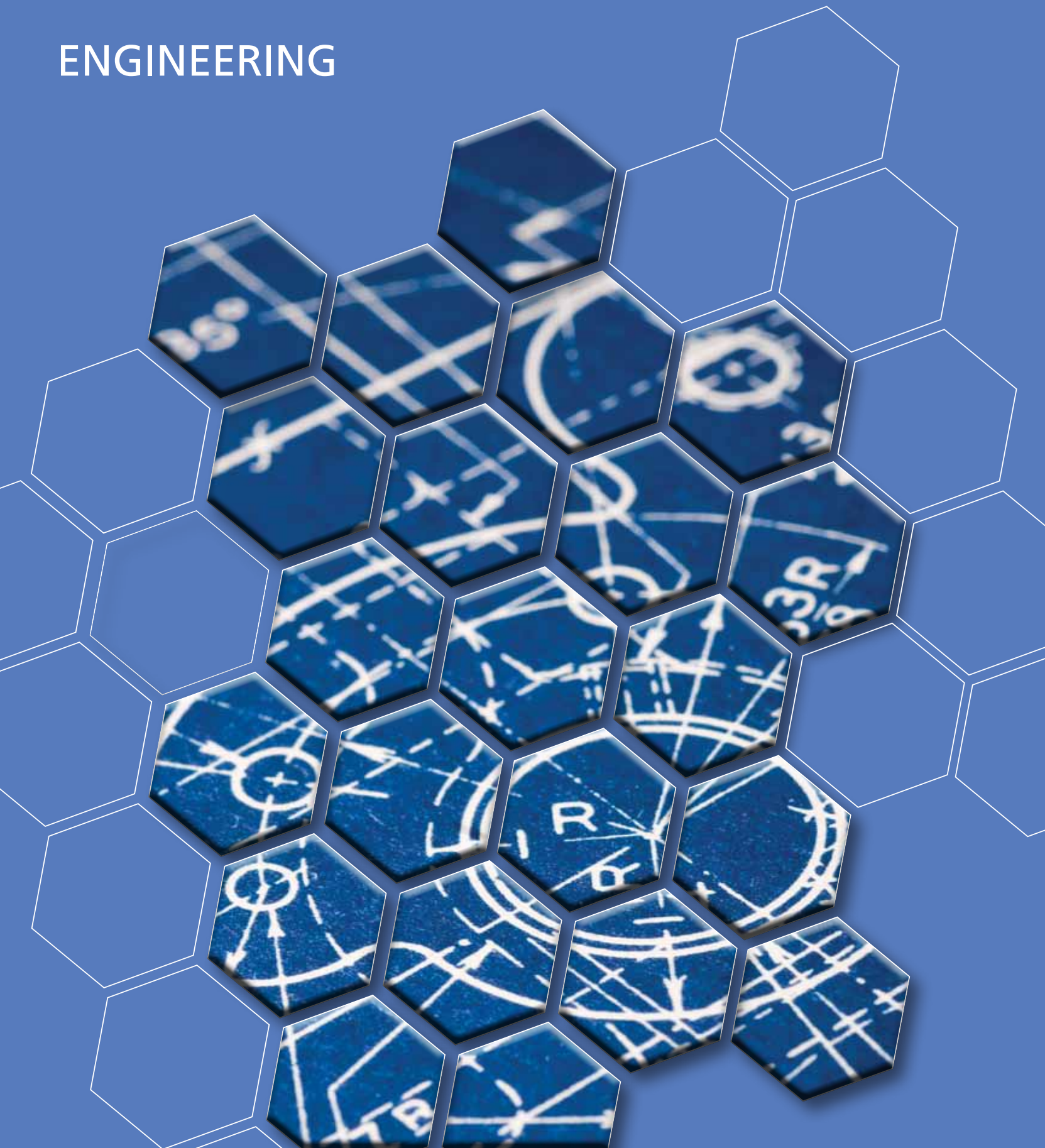
ENGINEERING



Kitio Kwuimy Cedrick Aurelien

African Institute for Mathematical Sciences

Mentor: B Green

Broad research area: Mechanical engineering

Specific research field: Optical and structural investigation of a proposed heliostat design

Purpose of study:

This research project investigates the optical and structural behaviour of a heliostat design for use in solar-thermal power stations. A solar-thermal power station typically requires several thousand heliostats for harvesting the sun's energy. This research will investigate a proposed design that is both easy to manufacture and maintain. Specifically, the proposed design requires on a single adjustment for tuning the optical characteristics of the heliostat. Effective control of the optical characteristics is important since each heliostat must be tuned individually. This research will require numerical modelling of the structural and optical performance of the proposed heliostat design. Numerical design optimisation will then be coupled with these numerical models to obtain a mass minimised finalised design that will satisfy the requirements of a South African-based solar-thermal power station.

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Adelaja Osibote

University of Cape Town

Mentor: T Douglas

Broad research area: Biomedical engineering

Specific research field: Autofocusing in bright-field microscopy for tuberculosis detection

Purpose of study:

Automated microscopy to detect *Mycobacterium tuberculosis* in sputum smear slides would enable laboratories in countries with a high tuberculosis burden to cope efficiently with large numbers of smears. Focusing is a core component of automated microscopy, and successful autofocusing depends on selection of an appropriate focus algorithm for a specific task. We examined autofocusing algorithms for bright-field microscopy of Ziehl–Neelsen stained sputum smears. Six focus measures, defined in the spatial domain, were examined with respect to accuracy, execution time, range, full width at half maximum of the peak and the presence of local maxima. Curve fitting around an estimate of the focal plane was found to produce good results and is therefore an acceptable strategy to reduce the number of images captured for focusing and the processing time. Vollath's F4 measure performed best for full z-stacks, with a mean difference of 0.27 μm between manually and automatically determined focal positions, whereas it is jointly ranked best with the Brenner gradient for curve fitting.

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Anthony Amankwah

Stellenbosch University

Broad research area: Process engineering

Specific research field: Automatic rock size estimation using the generalised voronoi diagram

Purpose of study:

Marker-driven watershed segmentation extracts seeds indicating the presence of rocks at specific image locations. The marker locations are then set to be regional minima within the topological surface (typically, the gradient or thresholds of the original input image, and the watershed algorithm is applied.) In contrast, our approach uses the generalised Voronoi diagram through Euclidian distance transform for the segmentation of the rock image after extracting the markers. Experimental results demonstrate that using Voronoi diagram can produce better estimation of fines in a rock samples.

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