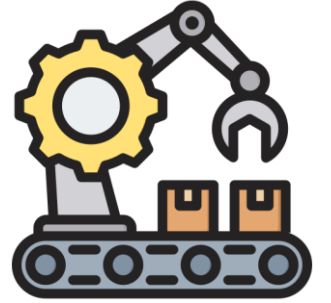


# Stellenbosch Engineering Industry Showcase

27 May 2026

Century City Conference Centre, Cape Town



- Results
- Prototypes
- Solutions
- Trends
- Systems
- Overview

A background image showing a hand typing on a laptop keyboard. Overlaid on the laptop screen is a white wind turbine and various data visualization elements like graphs and lines. The background is a dark purple and brown geometric pattern.

*Shaping the Future of Industry:  
The Rise of Reconfigurable  
Manufacturing  
Systems*



PRESENTED BY  
DR B.I. RAMATSETSE



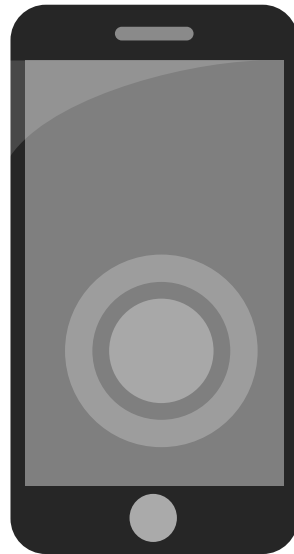
Results

Prototypes


Solutions

Trends

Systems




# OVERVIEW




**CHANGING CONSUMER DEMANDS**  
The next generation of manufacturing systems (NGMS) should be able to respond to change in demand, enabling companies to meet customer needs in real-time

ONE



**MASS CUSTOMIZATION**  
The next generation of manufacturing systems (NGMS) **should be able to produce a wide variety of customized products** at lower cost.

TWO



**SCALABILITY**  
The next generation of manufacturing systems (NGMS) should be able to scale production capacity up or down adding/removing machine modules.

THREE



**RESILIENCE TO DISRUPTIONS**  
The next generation of manufacturing systems (NGMS) should be able to recover quickly from failure by swapping or reconfiguring parts without needing a complete shutdown.

FOUR



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## DEDICATED SYSTEM



### DMS

System based on fixed automation and **produce products or parts at high-volume**. Each dedicated line is typically designed to produce a single part (e.g., specific engine block) at high production rate.

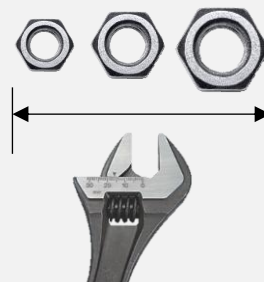


## FLEXIBLE SYSTEM



### FMS

A flexible manufacturing system is a manufacturing system in which there is some amount of flexibility that allows the system to react in case of changes, whether predicted or unpredicted.



## RECONFIGURABLE SYSTEM



### RMS

One designed at the outset for rapid change in its structure, as well as its hardware and software components, to quickly adjust its production capacity and functionality within a part family in response to sudden market changes.



Systems

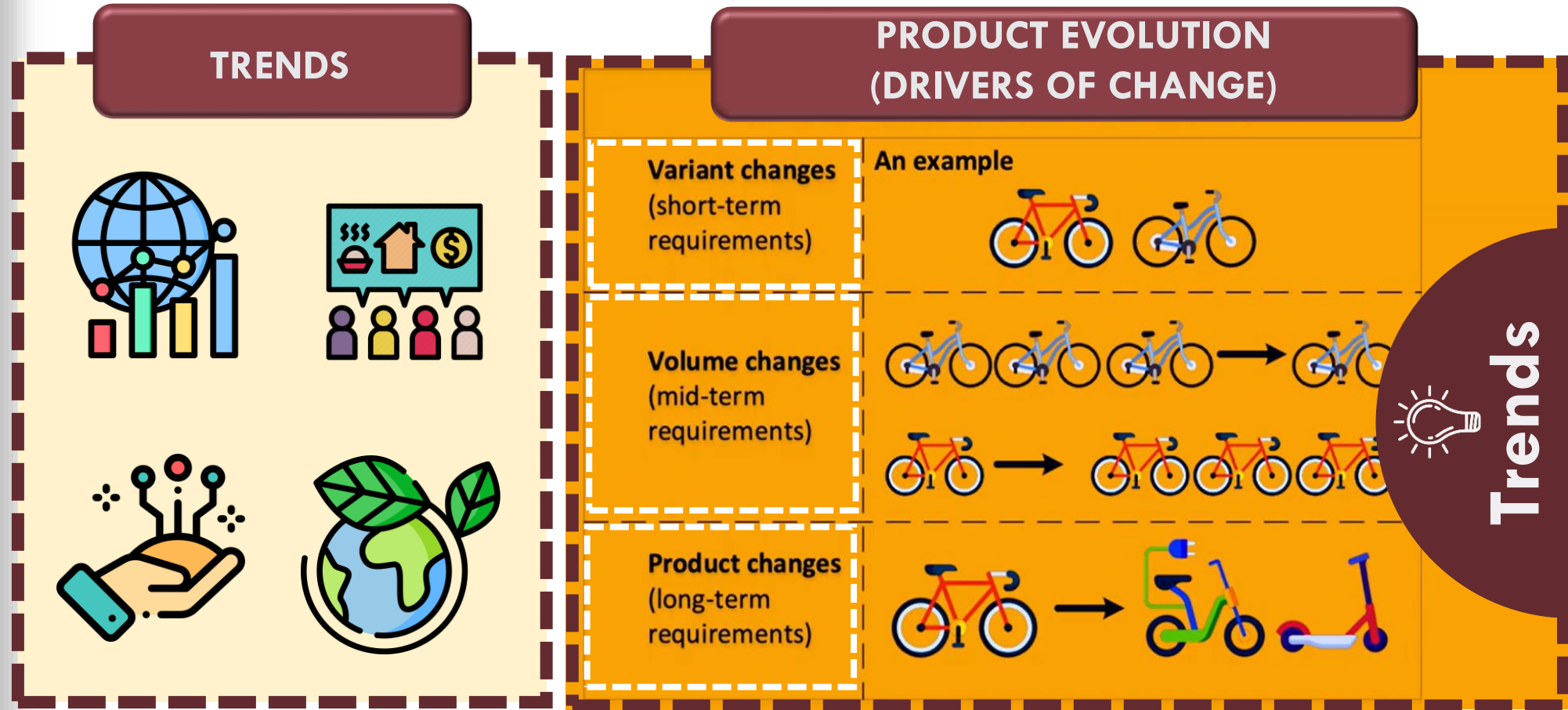
Overview

# SHAPING THE FUTURE OF INDUSTRY & ADDRESSING TRENDS WITH RECONFIGURABLE MANUFACTURING SYSTEMS

Results

Prototypes

Solutions



Source: Andersen et al. 2024

# DESIGNED MACHINE SOLUTIONS

**RECONFIGURABLE VIBRATING SCREEN (RVS)**

2 X 4

Geometry

Mesh analysis

Mathematical representation

Stress distributions

Legend for stress distributions:  
 1. 4.39E+07  
 2. 3.75E+07  
 3. 3.11E+07  
 4. 2.47E+07  
 5. 1.83E+07  
 6. 1.19E+07  
 7. 5.55E+06  
 8. 4.91E+06  
 9. 4.27E+06  
 10. 3.63E+06  
 11. 3.00E+06  
 12. 2.36E+06  
 13. 1.72E+06  
 14. 1.08E+06  
 15. 4.44E+05

**RECONFIGURABLE MACHINE TOOL (RMT)**

Headstock and Quill Mechanism

1. Motor Mount (Z Axis)
2. Motor Mount (X Axis)
3. Motor Mount (Y Axis)
4. Motor Mount (Z Axis)
5. Motor Mount (X Axis)
6. Motor Mount (Y Axis)
7. Tool Holder
8. Tool Holder
9. Tool Holder
10. Tool Holder
11. Tool Holder
12. Tool Holder
13. Tool Holder
14. Tool Holder
15. Tool Holder
16. Tool Holder
17. Tool Holder
18. Tool Holder
19. Tool Holder
20. Tool Holder

Module Library

**RECONFIGURABLE ASSEMBLY FIXTURES (RAF)**

Station 1 Station 2 Station 3 Station 4

Fixture Base

Fixture stand

Solenoid

Radiator

Fan

Water pump

**RECONFIGURABLE ROBOTIC END-EFFECTOR**

Step 1

Step 2

Step 3

SMR

SMR attachment

dir.  $Y_2$

Base Plane

Joint 1 = rotated  
Joint 2 to 6 = fixed

Joint 1 = 0°  
Joint 2 = rotated  
Joint 3 to 6 = fixed

Joint 1 to 6 = fixed

Results

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Trends

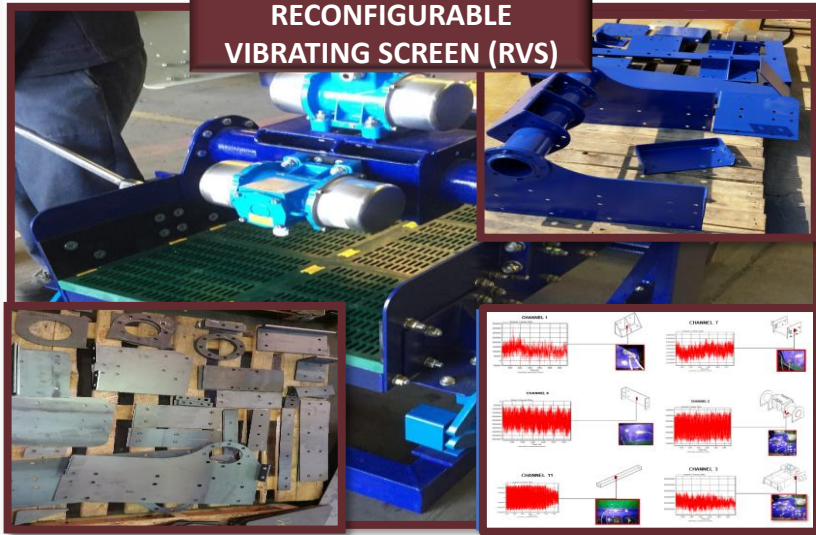
Systems

Overview

"A Design Isn't Finished Until Somebody Is Using It." - Brenda Laurel

# RMS PROTOTYPE MACHINE SOLUTIONS

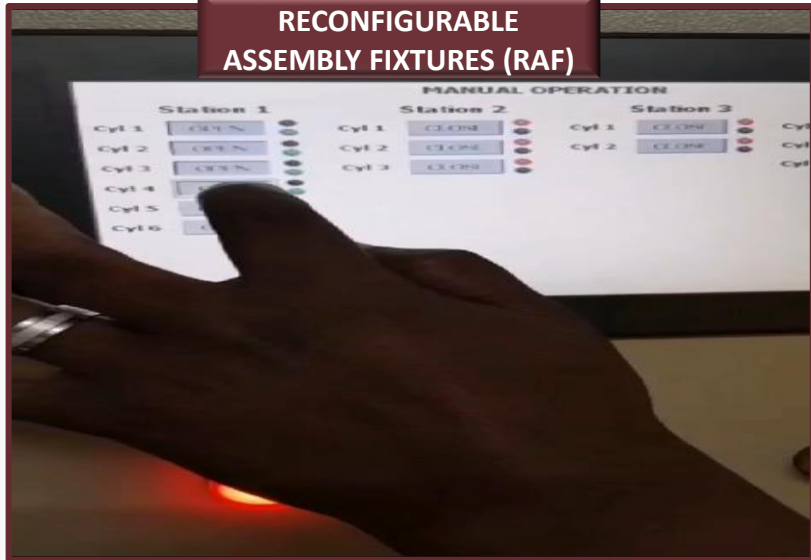
RECONFIGURABLE VIBRATING SCREEN (RVS)



RECONFIGURABLE ROBOTIC END-EFFECTOR



RECONFIGURABLE ASSEMBLY FIXTURE (RAF)



RECONFIGURABLE MACHINE TOOL (RMT)



Prototypes

Solutions

Trends

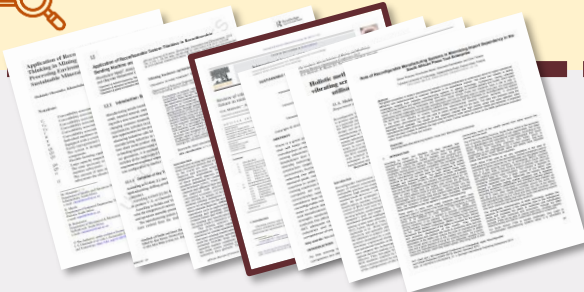
Systems

Overview

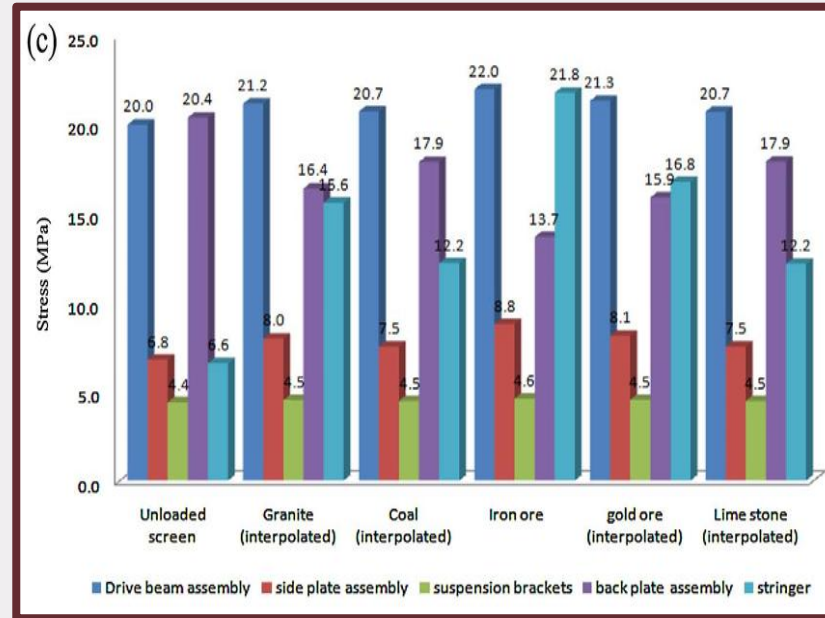
Results

## PUBLICATIONS RELATED TO RMS

### REVIEW STUDIES (ESTABLISHING REQUIREMENTS FOR RMS)



## RESEARCH RESULTS



### METHODOLOGY FOR RMS AND CHANGEABILITY



### DESIGN AND PERFORMANCE EVALUATION OF RMS



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#### Straightness Tests Aggregated Results

| Sample | Spindle Speed (RPM) | Slot Orientation | Slot Width (mm) | Avg. ref. points Deviation (mm) | Error (%) |
|--------|---------------------|------------------|-----------------|---------------------------------|-----------|
| 1      | 10, 000             | X-axis           | 6               | 0.16                            | 114.17    |
|        |                     |                  | 8               | 0.13                            |           |
|        |                     | Y-axis           | 6               | 0.09                            | 51.18     |
|        |                     |                  | 8               | 0.04                            |           |
| 2      | 20, 000             | X-axis           | 6               | 0.16                            | 110.24    |
|        |                     |                  | 8               | 0.12                            |           |
|        |                     | Y-axis           | 6               | 0.06                            | 51.18     |
|        |                     |                  | 8               | 0.07                            |           |

#### Circularity Test Aggregated Results

| Sample | Spindle Speed (RPM) | Measurement                   | Avg. ref. points Deviation (mm) | Error (%) |
|--------|---------------------|-------------------------------|---------------------------------|-----------|
| 1      | 10, 000             | Small Circle                  | 0.12                            | 104.33    |
|        |                     | Medium Circle                 | 0.23                            |           |
|        |                     | Large Circle                  | 0.04                            |           |
|        |                     | Avg. Distance between Circles | 0.14                            |           |
|        |                     |                               |                                 |           |
| 2      | 20,000              | Small Circle                  | 0.14                            | 120.08    |
|        |                     | Medium Circle                 | 0.24                            |           |
|        |                     | Large Circle                  | 0.06                            |           |
|        |                     | Avg. Distance between Circles | 0.17                            |           |
|        |                     |                               |                                 |           |

# OUR PARTNERS



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Research Partners



Business  
Incubator Partners



Manufacturing  
Partners



**THANK  
YOU**

**BAIE  
DANKIE**



Dr Boitumelo Innocent Ramatsetse



2021 NSTF-South32 Award Winner: TW Kambule-NSTF Emerging Researcher

2024 National Research Foundation (NRF) Emerging Researcher

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