Mechanical Design and Automation Portfolio

RUSHIKESH ABHALE

Mechanical Engineer | M. Eng. Industry 4.0

About Me

I’ve always been drawn to the quiet logic behind how things work; the way a mechanism moves, how a system responds, and how small design decisions can shape real-world performance. That curiosity carried me from studying mechanical engineering in Pune to Berlin, where I explored Industry 4.0, mechatronics and automation more deeply.

Along the way, I’ve worked in environments where ideas move fast, like prototyping labs, R&D teams and classrooms filled with the engineering students. Each role added something to my way of thinking, from the discipline of precise design to the patience of teaching to the practical mindset needed to turn concepts into robust, functioning systems.

What motivates me most is the moment when a vague idea starts taking shape, when sketches become CAD, when iterations reveal insights and when a prototype finally clicks. I enjoy problems that demands both structure and creativity, where engineering is not just about solving tasks but about understanding the story behind them.

Today, I work at the intersection of mechanical design, automation and system thinking. I’m driven by clarity, meaningful challenges and the desire to build solutions that work reliably in the real world. This portfolio brings together the projects that have shaped that journey and continue to guide how I create, learn and contribute.

How I Work

Over the years, I've developed a working philosophy built on four core principles:

- **Systems Thinking**
  Understanding how mechanical, electrical, and control layers interact, and designing with the whole system in mind.
- **Hands-On Development**
  Prototyping, testing, iterating, and solving the practical problems that only appear on the shop floor not just in CAD.
- **Optimization Mindset**
  Streamlining assemblies, improving reliability, refining tolerances, and pursuing simplicity without sacrificing performance.
- **Safety & Standards**
  Ensuring every design meets the practical demands of real industrial environments, from robustness to safety compliance.

My Engineering Journey

Technical Trainer (Freelance)
SRH Hochschule | Berlin
October 2024 — September 2025

Mechanical Design Engineer (Working Student)
ENWAY - A Bucher Company | Berlin
May 2020 — March 2022

CAD Engineer (Project based)
Digimind | Berlin
January 2021 — April 2021

M.Eng. Engineering & Sustainable Technology Management — Industry 4.0
SRH Hochschule | Berlin
March 2020 – September 2022

Mechanical Design Engineer
Autotechnik | Pune, India
June 2017 — December 2019

B.Eng. Mechanical Engineering
University of Pune | Pune, India
July 2013 — May 2017

Technical Snapshot

- **Domains**
  Mechanical Design · Mechatronics · Automation
- **Industries**
  Automotive · Robotics · FMCG · Defense · Industrial Systems
- **Product Development**
  FEA/M · Rapid Prototyping · DFMA · GD&T · Tolerance Analysis · Root Cause Analysis
- **CAD / CAE**
  SolidWorks · Creo · Inventor · AutoCAD · NX · ANSYS
- **Validation and Commissioning**
  FAT · SAT · RAMS · SOP
- **Automation**
  Sensors · Pneumatics · Hydraulics · PLC (Siemens TIA Portal)
- **Communication**
  English (C2) · German (B2)

Featured Engineering Work

Seat-Belt Emergency Locking Retractor (ELR) Assembly Line

Role: Project Lead

Modernized semi- automated ELR line to double throughput and cut operator count in half.

Highlights: Servo winding · Hydro-pneumatic riveting · Rotary indexing · SMED tooling

Impact: Cycle 12 s → 6 s · Operators 12 → 5 · Changeover < 5 min

View More →

Precision Riveting Machine

Role: Lead Mechanical Design Engineer

High-precision riveting system for seat-belt buckle components with ±25 µm repeatability and < 2 min changeover.

Highlights: Hydropneumatic press · LVDT feedback · Quick-change fixtures

Impact: 98.5 % FPY · 21 → 2 min setup reduction

View More →

Autonomous Industrial Sweeping Robot – Subsystem Development

Role: Mechanical Design Engineer (Working Student)

Developed IP65 mechanical subsystems for autonomous cleaning robot, from prototype to series production.

Highlights: Brush optimization · DFMA · Rapid prototyping · SolidWorks PDM

Impact: +45 % cleaning efficiency · ~30 % faster assembly

View More →

Conceptual image — for illustration purposes only; proprietary data not disclosed.

Technical Trainer – Mechatronics & Automation Lab

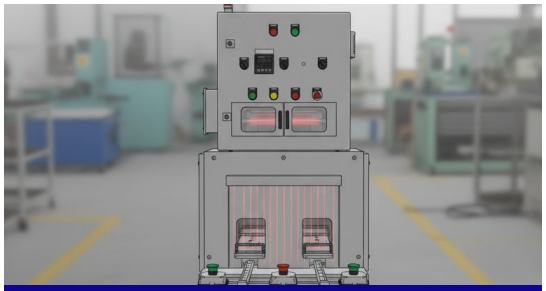
Role: Technical Trainer

Designed and delivered practical modules in automation systems, sensors, actuators, PLCs, and CAD.

Highlights: Automated assembly line · Siemens TIA Portal · Autodesk Inventor · CAD

Impact: 250+ students trained · Improved readiness for industrial automation roles

View More →



Buckle Strap Heat-Shrink Machine – Automotive Safety

Role: Mechanical Design Engineer

Semi-automatic dual-fixture machine for heat-shrinking buckle sleeves with full safety integration.

Highlights: Dual-fixture · Pneumatic slides · Industrial guarding · DFMA

Impact: ~6 s cycle (2 pcs) · 3 s/part throughput · Validated heat profile

View More →

Packaging Design Optimization – FMCG

Role: CAD Engineer

Parametric modeling to cut laser-processing time while maintaining box strength and easy assembly.

Highlights: DOE optimization · ANSYS validation · DXF/G-code workflow

Impact: -24 % laser time · 100 + design iterations · Maintained stiffness

View More →

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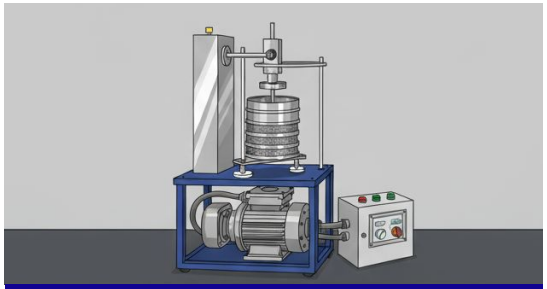


Flame-Proof Sieve Shaker – Defense Testing Equipment

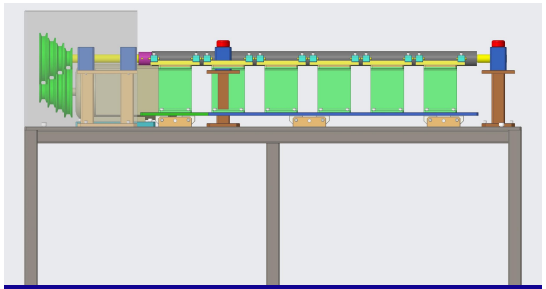
Role: Mechanical Design Engineer

Explosion-safe test rig with 300 RPM shaking + 150 taps/min for sieving explosive materials.

Highlights: Cam-based tapping · Flame-proof motor · Elastomer damping · Adjustable speed

Impact: Certified safety compliance · Stable amplitude & tapping consistency

View More →



Tube Slitting Machine – Defense Manufacturing

Role: Mechanical Design Engineer

Automated multi-blade slitting SPM for fragile tubes with precision chuck-tailstock holding.

Highlights: 6-blade rotary head · Hiwin feed · Flame-proof controls · DFMA

Impact: 6 cuts/cycle · 200 mm adjustable length · Reduced setup & cycle time

View More →

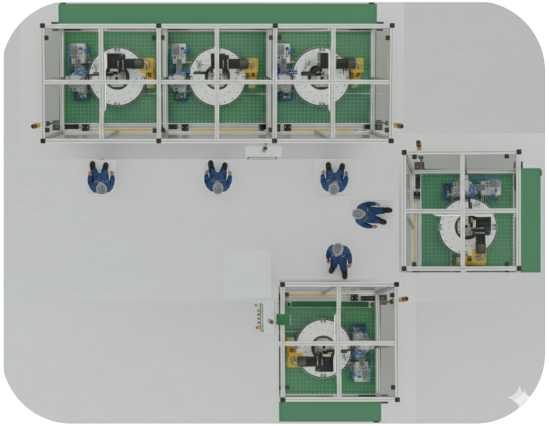
Conceptual image — for illustration purposes only; proprietary data not disclosed.

Seat-Belt Emergency Locking Retractor (ELR) Assembly Line

AUTOTECHNIK (06.2017 — 12.2019)

AUTOTECHNIK (06.2017 — 12.2019)

Seat-Belt Emergency Locking Retractor (ELR) Assembly Line



Industry: Automotive – Occupant Safety Systems

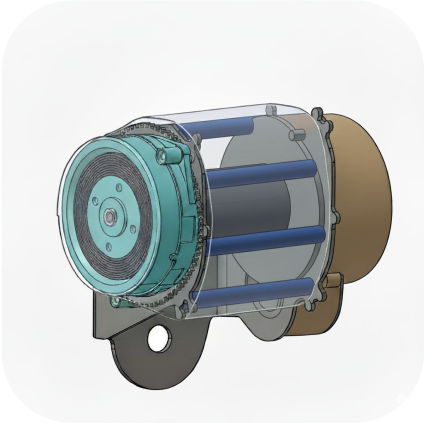
Role: Project Lead and Mechanical Design

Goal : Modernize a semi-automated ELR assembly line to enhance throughput, ergonomics, uptime, and multi-variant flexibility. (*Note: ELR is a safety-critical seat-belt mechanism that locks during crash)*

System Overview

5 Machine Modules × 4–5 Stations Each

- Servo-driven spring winding
- Gravity & hydro-pneumatic riveting
- Servo alignment and press-fit assembly
- Rotary indexing transfer system
- LVDT-based in-process gauging
- Pneumatic pick-and-place handling
- SMED-based quick-change tooling



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AUTOTECHNIK (06.2017 — 12.2019)

Seat-Belt Emergency Locking Retractor (ELR) Assembly Line

Key Contributions

- Led technical reviews with OEM engineers
- Designed actuation systems, fixtures, tooling, and layouts
- Performed tolerance analysis, FEA and DFMA
- Established control architecture and process plan
- Supervised vendor management, FAT, and on-site commissioning

Tools & Technologies

Creo · ANSYS · AutoCAD · FluidDraw · GD&T · DFMA · SMED · Pneumatics / Servo Systems

IMPACT

HIGH	2X FAST	-58%	< 5 MIN
YIELD	CYCLE TIME 12s → 6s	OPERATORS 12 → 5	CHANGEOVER

Conceptual image — for illustration purposes only; proprietary data not disclosed.

Precision Riveting Machine

AUTOTECHNIK (06.2017 — 12.2019)

AUTOTECHNIK (06.2017 — 12.2019)

Precision Riveting Machine

Industry: Automotive – Occupant Safety Systems

Role: Lead Mechanical Design Engineer (Concept → Commissioning)

Goal: Develop a high-precision riveting system for seat-belt buckle assemblies

System Overview: 5-Station Automated Machine

- Loading: Vision-guided variant ID, poka-yoke fixture, part-presence verification
- Pre-Press: Pneumatic pre-alignment for accurate rivet seating
- Riveting: 20 t hydropneumatic cylinder with load-cell feedback & overload clutch
- Gauging: LVDT measures rivet height (±25 µm); auto pass/fail to PLC
- Unloading: Pick-and-place to accept/reject conveyor

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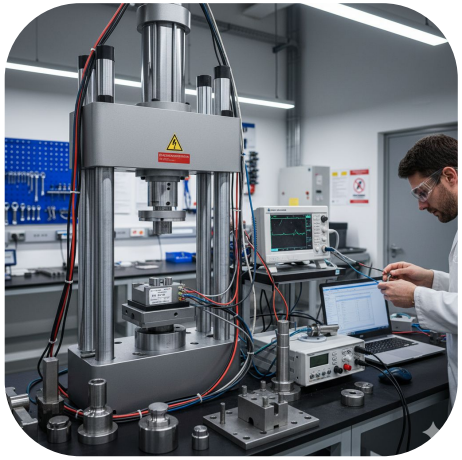
AUTOTECHNIK (06.2017 — 12.2019)

Precision Riveting Machine

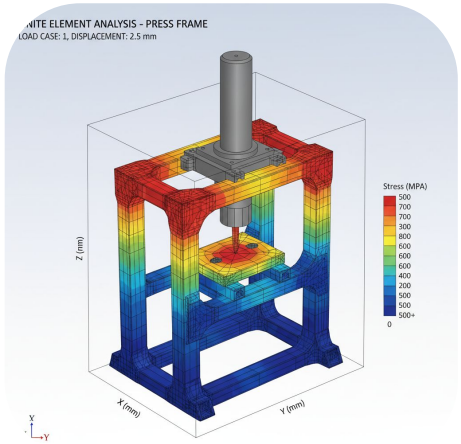


Key Contribution

- Designed mechanical architecture, actuation systems, and fixtures
- Performed GD&T tolerance stack-up and FEA
- LVDT integration for closed-loop height control
- Executed FAT / SAT and full documentation
- Coordinated with cross functional teams, clients, suppliers and vendors

Tools & Technologies

Creo · ANSYS · DFMA · GD&T · Pneumatics / Hydraulics · Siemens PLC Interface · Safety Design · Sensor Technology



IMPACT

≥ 25 µm	98.5%	20+	< 2 MIN
ACCURACY	YIELD	VARIANTS SUPPORTED	CHANGEOVER

Conceptual image — for illustration purposes only; proprietary data not disclosed.

Autonomous Industrial Sweeping Robot — Subsystem Development

ENWAY - A Bucher Company (05.2020 — 03.2022)

ENWAY - A Bucher Company(05.2020 — 03.2022)

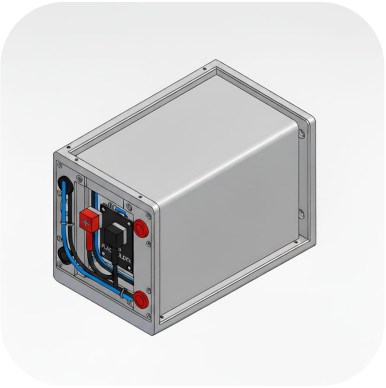
Autonomous Industrial Sweeping Robot – Subsystem Development

Industry: Robotics / Industrial Cleaning Systems | **Role:** Mechanical Design Engineer (Working Student)

Goal: Design, develop, and industrialize key mechanical subsystems for an autonomous sweeping vehicle, ensuring durability, manufacturability, and optimized cleaning performance under industrial conditions.

Key Contributions

- Designed IP65-rated sheet-metal enclosures, covers, sensor mounts and battery modules
- Designed fixtures and alignment guides, achieving ~30% faster assembly
- Built, tested and validated prototypes and transitioned designs to production
- Created BOMs, manufacturing drawings, maintenance manuals, and SOPs
- Trained production teams



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ENWAY - A Bucher Company(05.2020 — 03.2022)

Autonomous Industrial Sweeping Robot – Subsystem Development

Cleaning Mechanism Optimization

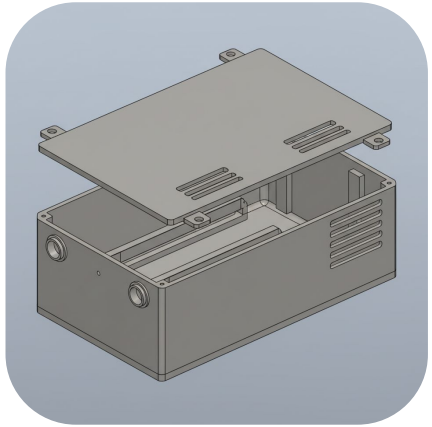
- Built a bench test rig to evaluate brush parameters (angle, contact pressure, stiffness, vehicle speed)
- Redesigned brush mount and kinematics, resulting in +45% sweeping efficiency

Production Tooling

- Designed fixtures and alignment guides, achieving ~30% faster assembly

Tools & Technologies

SolidWorks · SolidWorks PDM · DFMA · Rapid Prototyping · Root Cause Analysis



IMPACT

+45%	TRAINED	-30%	8+
CLEANING EFFICIENCY	PRODUCTION TEAM	ASSEMBLY TIME	SUBSYSTEMS DEVELOPED

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Trainer — Mechatronics, Automation & CAD

SRH HOCHSCHULE BERLIN (10.2024 — 09.2025)

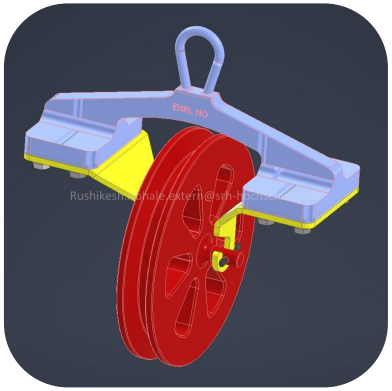
SRH HOCHSCHULE BERLIN (10.2024 — 09.2025)

Trainer – Mechatronics, Automation & CAD

Hands-on training for Master's and Bachelor's students, focused on developing industry-ready engineers skilled in automation systems, sensors, actuators, PLC programming, and CAD design.

Core Teaching Areas

- **Mechatronics Hardware:** Sensors, actuators (pneumatic, hydraulic, electromechanical)
- **Control Systems:** Siemens TIA Portal – FBD, GRAPH7, Functions, Function Blocks
- **CAD & Design:** Autodesk Inventor – 2D/3D design, assemblies, sheet metal, DFMA, DIN/ISO
- **Mechanical:** Gears, shafts, bearings, couplings, springs
- **Workshops Planning:** Welding, turning, soldering, metal fabrication (Handwerkskammer Berlin)



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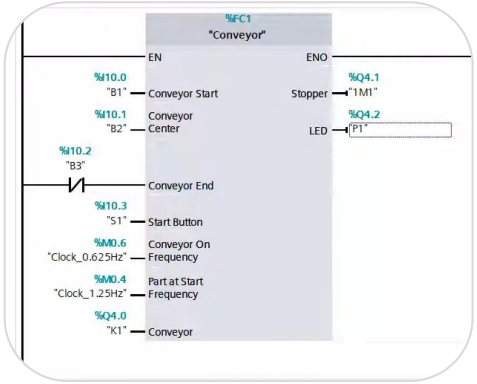
SRH HOCHSCHULE BERLIN (10.2024 — 09.2025)

Trainer – Mechatronics, Automation & CAD

Training Environment

Automated 7-Station Valve Assembly Line, featuring:

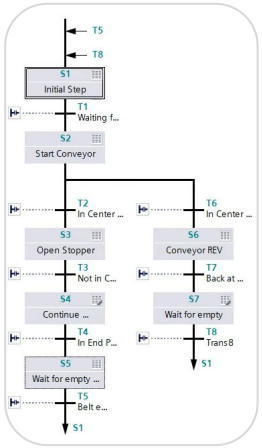
- Station loading & part presence sensing
- Pneumatic pick-and-place mechanisms
- Screw-driving & pressing modules
- Height gauging & rotary part orientation
- Sorting & unloading conveyors

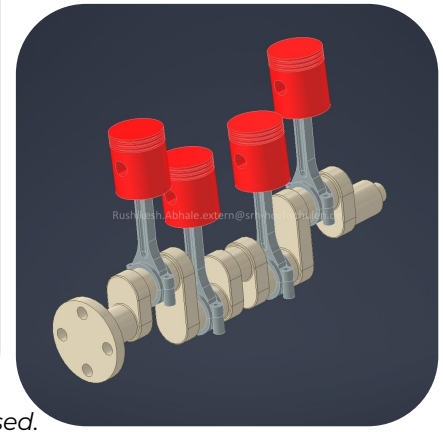


https://amatrol.com/

Outcomes & Impact

- Prepared students for industrial automation roles in PLC programming, system integration, and troubleshooting
- Trained students in CAD and design principles, enabling them to create manufacturable, industry-ready designs
- Trained 250+ students with consistently excellent feedback
- Enhanced laboratory safety culture and procedural discipline





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Buckle Strap Heat-Shrink Machine

AUTOTECHNIK (06.2017 — 12.2019)

AUTOTECHNIK (06.2017 — 12.2019)

Buckle Strap Heat-Shrink Machine

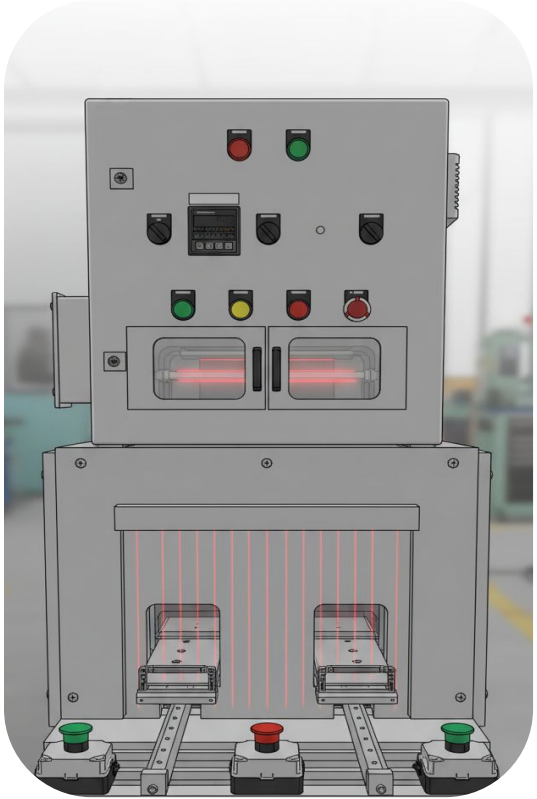
Industry: Automotive – Occupant Safety Systems

Role: Mechanical Design Engineer

Goal:
Develop a semi-automatic heat-shrink station for seat-belt buckle straps, optimizing cycle time and operator ergonomics while ensuring process safety and repeatability.

System Overview

- Dual-fixture workstation enabling 2-part simultaneous processing
- Linear-guided sliding fixtures for ergonomic part exchange
- Heater enclosure with controlled airflow and temperature stability
- Operator guarding and interlock system ensuring safe cycle start
- Integrated control panel for process timing and heat regulation



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AUTOTECHNIK (06.2017 — 12.2019)

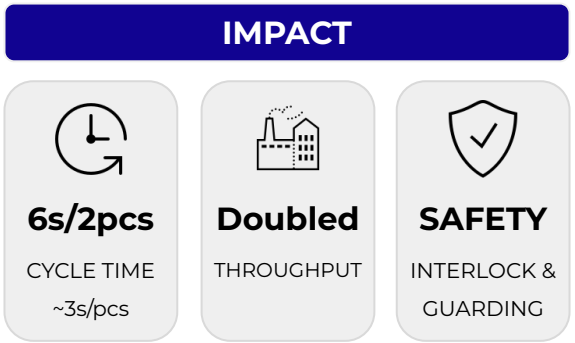
Buckle Strap Heat-Shrink Machine

Key Contribution

- Designed fixtures, table, mounting, safety enclosure, and control console
- Created manufacturing drawings and RAMS documentation
- Performed tolerance analysis and DFMA
- Executed FAT and supported on-site commissioning

Tools & Technologies

Creo · DFMA · Pneumatics · Industrial Safety Standards · RAMS · FAT/SAT



FMCG Packaging Design Optimization

DIGIMIND (01.2021 — 04.2021)

DIGIMIND (01.2021 — 04.2021)

FMCG Packaging Design Optimization

Industry: FMCG Packaging / Digital Manufacturing

Role: CAD Engineer

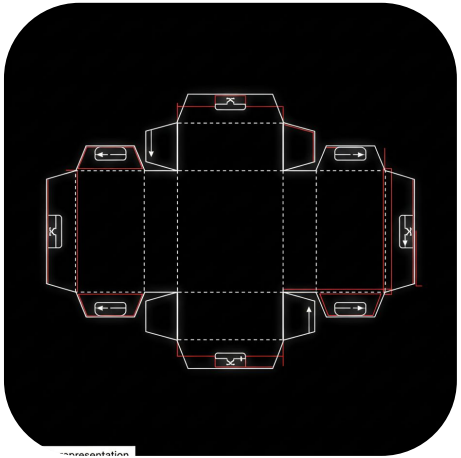
Goal: Develop and optimize a parametric cardboard packaging design to minimize laser-cutting time while maintaining form strength, assembly integrity, and manufacturability.

Key Contribution

- Created parametric 3D model and 2D laser cutting drawings
- Analyzed G-code for cutting paths to measure tool travel and dwell time
- Conducted Design of Experiments (DOE) and FEA
- Selected the optimal geometry balancing cutting efficiency and structural integrity

Tools & Technologies

Autodesk Inventor · AutoCAD · ANSYS · DFMA · DXF/G-code Workflow



IMPACT

-24%
PRODUCTION TIME

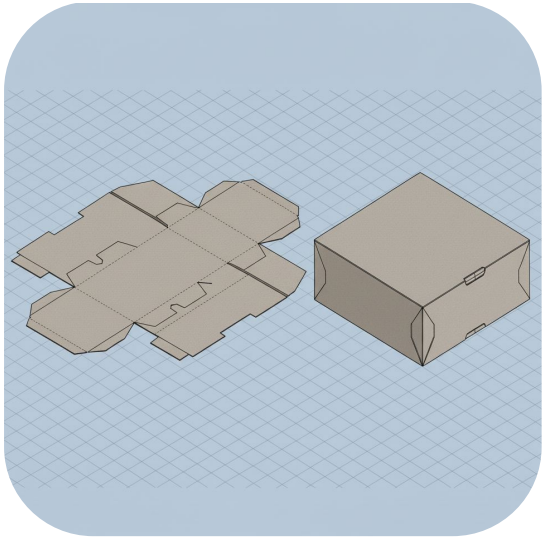
MAINTAINED
STRUCTURAL INTEGRITY

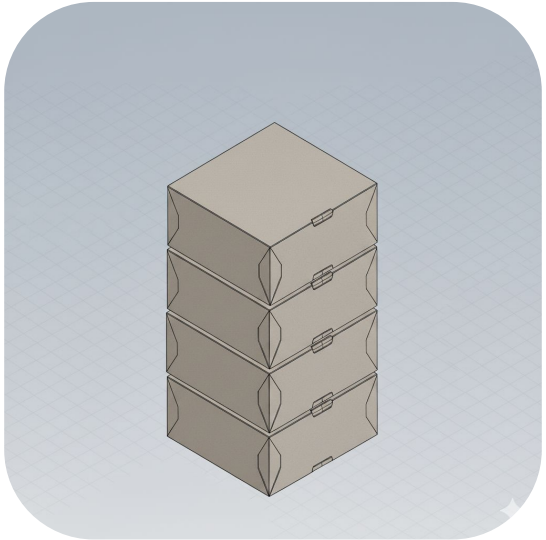
100+
PARAMETRIC DESIGNS

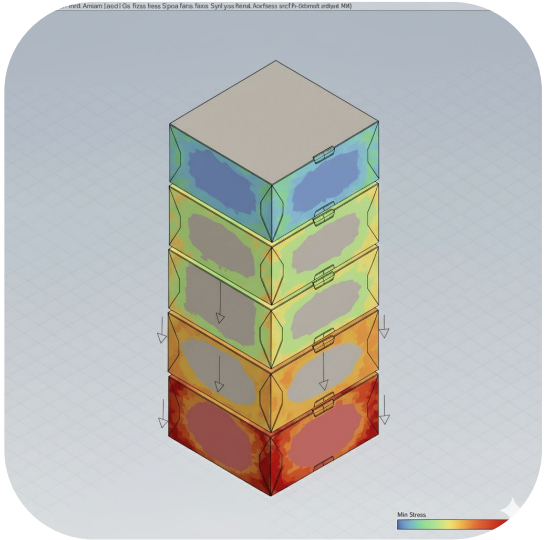
Conceptual image — for illustration purposes only; proprietary data not disclosed.

DIGIMIND (01.2021 — 04.2021)

FMCG Packaging Design Optimization







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Flame-Proof Sieve Shaker – Defense Testing Equipment

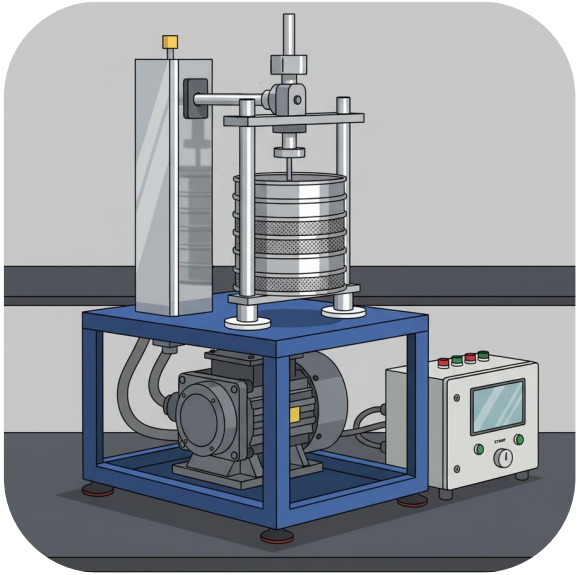
AUTOTECHNIK (06.2017 — 12.2019)

AUTOTECHNIK (06.2017 — 12.2019)

Flame-Proof Sieve Shaker

Industry: Defense | **Role:** Mechanical Design Engineer

Goal: Design a flame-proof sieve shaker for explosive material testing



System Overview

- 8-sieve stack configuration for particle size separation
- Motor-driven shaking and cam-based tapping mechanism
- Flame-proof motor and electronics

Key Contribution

- Designed drivetrain components – gearbox, drive shaft, hub, and coupling
- Developed shaking linkage and tapping cam mechanism with elastomer damping
- Created detailed CAD models, manufacturing drawings, and assembly documentation
- Conducted FAT/SAT, safety validation, and prepared RAMS documentation

Conceptual image — for illustration purposes only; proprietary data not disclosed.

AUTOTECHNIK (06.2017 — 12.2019)

Flame-Proof Sieve Shaker

Key Contribution

- Designed drivetrain components – gearbox, drive shaft, hub, and coupling
- Developed shaking linkage and tapping cam mechanism with elastomer damping
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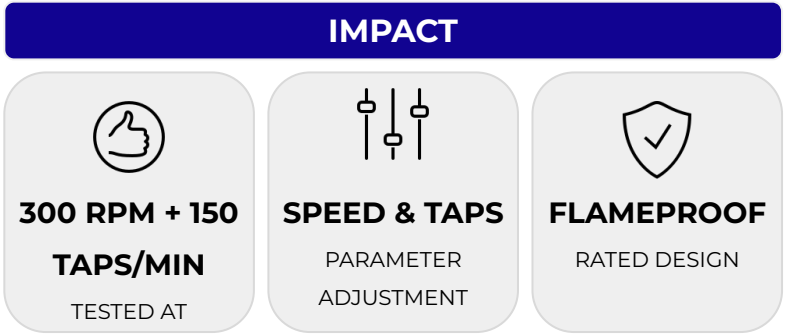
Tools & Technologies

Creo · DFMA · Safety Design · Flame-Proof Enclosure Standards · RAMS



Tube Slitting Machine – Defense Manufacturing

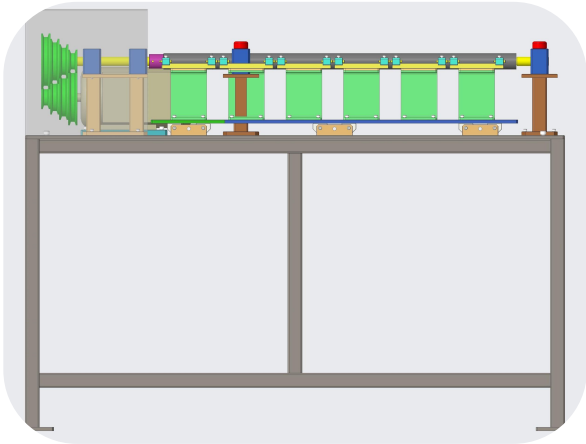
AUTOTECHNIK (06.2017 — 12.2019)

AUTOTECHNIK (06.2017 — 12.2019)

Tube Slitting Machine – Defense Manufacturing

Industry: Defense | **Role:** Mechanical Design Engineer

Goal: Design a slitting machine for delicate vacuum-cast tubes



System Overview

- Custom chuck + tailstock assembly for concentric tube clamping
- 6-blade rotary slitting head and linear feed system on Hiwin rails
- Adjustable cut length control (up to 200 mm per segment)
- Flame-proof control panel with interlock and safety curtains

Key Contribution

- Designed chuck, tailstock, cutting tool, and feed slides
- Integrated safety enclosure, E-stop system, and flame-proof electricals
- Created manufacturing drawings, and assembly documentation
- Supported FAT/SAT, vendor supervision, and manufacturing trials

Tools & Technologies

Creo · DFMA · Linear Motion Systems · Pneumatics · Industrial Safety Integration · RAMS

IMPACT

6 CUT/CYCLE	UPTO 200MM	QUALITY
CUTTING CAPACITY	LENGTH ADJUSTMENT	NO DEFORMATION OR BURR

Conceptual image — for illustration purposes only; proprietary data not disclosed.

Contact

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