SERGEI PAPKOV • FULL-STACK MECHATRONICS ARCHITECT

KINEMATICS DYNAMICS HARDWARE

I design robots, machines and devices for hardware startups, from a blank page to a working unit.

From 4-week R&D Sprints • From $10,000

Book a 20-min call →

SELECTED WORKS • 2026

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WHO YOU WORK WITH

One engineer from blank page to the factory floor.

Six years as CEO and CTO of my own automation and R&D company. Mechanics, motion, controls and commissioning in one head, so nothing gets lost between teams.

50+	12+ years	10+	2 weeks
systems delivered, blank page → commissioning	designing robots and industrial machines	industries, each with its own rules	blank page → serial production

Industrial-grade by default: machines designed to run in production, not just in a demo.

PRODUCTION SYSTEMS DELIVERED FOR

Nuclear plant · Aerospace industry · Composite materials production · Ex / ATEX zones

CLIENTS

ARISTON	HILTI	DKC	ORTONIK
Water heating equipment	Construction fastening systems	Electrical equipment	Medical equipment

SELECTED WORKS

01 Delta robot, from a blank page to a sold prototype
02 One unit every 4 seconds, every unit verified
03 Underwater repair robot for nuclear spent-fuel pools
04 ±0.1 mm on aramid honeycomb, checked after every cut
05 16 synchronized axes in explosion-proof zones
06 7 synchronized axes at 100 m/min
07 Blank page to serial production in 2 weeks
08 Nuclear plant equipment, proven in simulation

01 • KINEMATICS

Delta robot, from a blank page to a sold prototype

Kinematics with machine vision · The stage-one prototype sold

PROBLEM

Industrial delta robots are too expensive for many high-speed pick-and-place tasks. The goal: a parallel robot at half the production cost, on an open hardware and software stack, without a team.

EXECUTION

Parallel linkage and frame designed in Siemens NX. Kinematic solvers and trajectory generation in Python on a Raspberry Pi; real-time motion control in C on an STM32 microcontroller; global-shutter camera with OpenCV for part detection; web HMI for control and telemetry.

RESULT

A working robot built end to end by one engineer, at about half the production cost of industrial delta robots. The stage-one prototype was sold to a customer.

MY ROLE

Sole engineer: mechanics, kinematics, electronics, firmware, vision and calibration.

KEY METRICS

1	−50%	2 weeks
Engineer instead of a team	Production cost vs industrial delta robots	Mechanical design

VIDEO Watch it move ↗



One unit every 4 seconds, every unit verified

HILTI · Fully automatic assembly station

PROBLEM

Manual assembly of 8 mounting-nut variants (M8–M16) was too slow and let defects through. Target: under 5 seconds per unit, zero manual defects.

EXECUTION

A universal station with synchronized vibratory feeders, servo motion and press-fit sensing that verifies every assembly. One machine covers all 8 variants.

RESULT

Fully automatic cycle at one unit every 4 seconds: about 900 units per hour, no operator in the cycle, every unit checked in-line before it leaves the station.

MY ROLE

Concept, mechanical design, controls and commissioning: turnkey delivery.

KEY METRICS

900 / h	0	100%
Units per hour (4 s cycle)	Operators in the cycle	Units checked in-line

VIDEO Watch it run ↗



Underwater repair robot for nuclear spent-fuel pools

Nuclear power plant · System architecture · Active R&D

PROBLEM

Liner repair inside a spent-fuel pool means welding under water, in 60 °C borated water, under a 6 MGy cumulative dose. People can’t go there, and standard automation fails: seals degrade and electronics die.

EXECUTION

Full system architecture of an automatic submerged welding robot: a floating platform above water, a submersible platform anchored to the liner with vacuum grippers, a manipulator with welding head, surface preparation, ultrasonic testing and leak detection, all fed through one umbilical.

RESULT

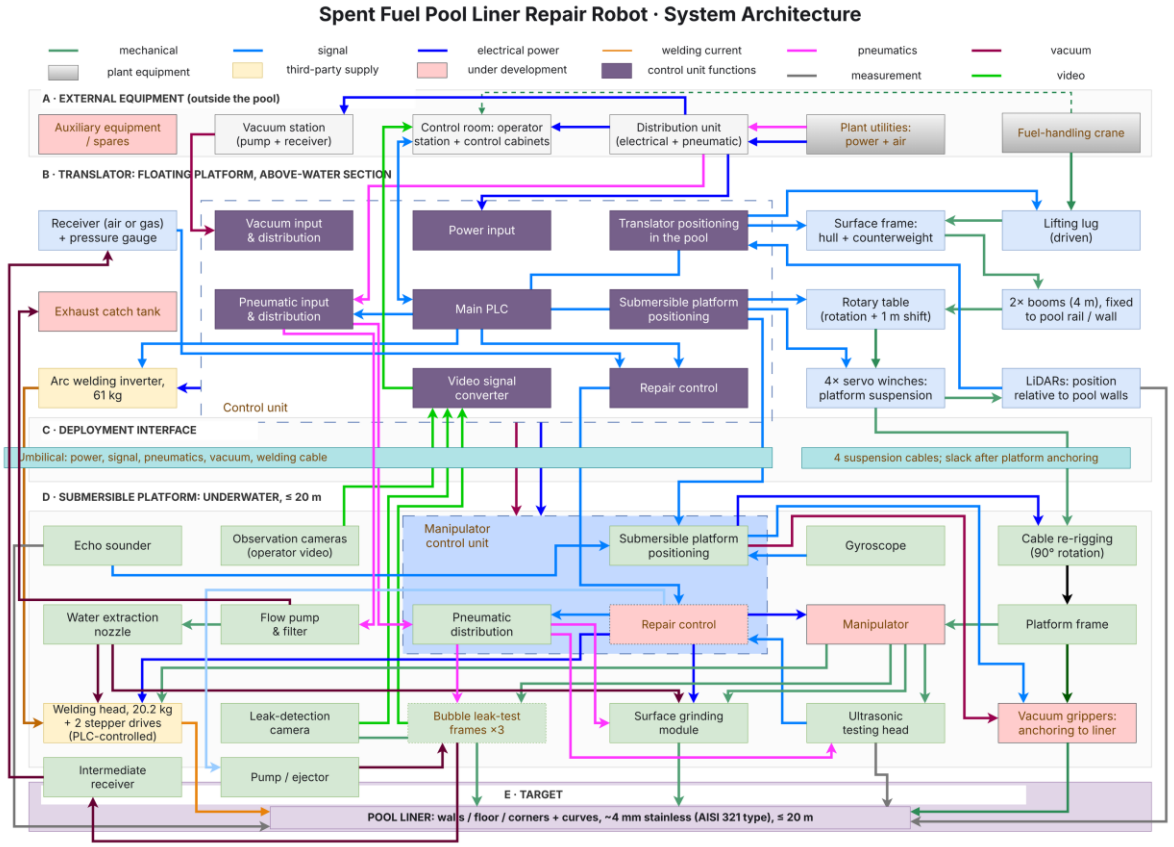
System architecture and technical design in progress (2026), designed for seismic Category I and radiation-resistant materials from day one.

MY ROLE

Lead mechatronics architect, solo: system architecture, layout, kinematics, materials selection, structural FEA.

KEY METRICS

1	6 MGy	60 °C
Engineer on the full system architecture	Radiation design envelope	Borated water, depth ≤ 20 m



04 • PRECISION

±0.1 mm on aramid honeycomb, checked after every cut

5-axis CNC band saw · Aerospace interior panels

PROBLEM

An aerospace client bought pre-cut aramid honeycomb from overseas: expensive, with weeks of lead time for every new interior part.

EXECUTION

A 5-axis CNC vertical band saw on Bosch Rexroth CNC and drives, with Renishaw probing that measures the part after every cut, a vacuum table and cyclone dust extraction.

RESULT

Cutting moved in-house: material cost cut in half through optimized nesting, lead time for new parts down from weeks to days, every cut verified to aerospace tolerance.

MY ROLE

Lead design engineer.

KEY METRICS

−50%	days	±0.1 mm
Material cost	Lead time for new parts (was weeks)	Verified after every cut

VIDEO Watch it run ↗



05 • COMPOSITE MATERIALS PRODUCTION

16 synchronized axes in explosion-proof zones

Prepreg production line · Ex-proof impregnation machine

PROBLEM

Carbon and glass-fiber prepregs are made with volatile resins: constant tension and thickness are needed across the whole line, inside explosion-hazard zones.

EXECUTION

A continuous line from fiber unwinding to impregnation and curing: 16 axes on one EtherCAT network with Safety over EtherCAT, multi-zone curing up to 300 °C, an ATEX drying chamber.

RESULT

Composite material production in-house, in one continuous line, in a certified explosion-proof setup.

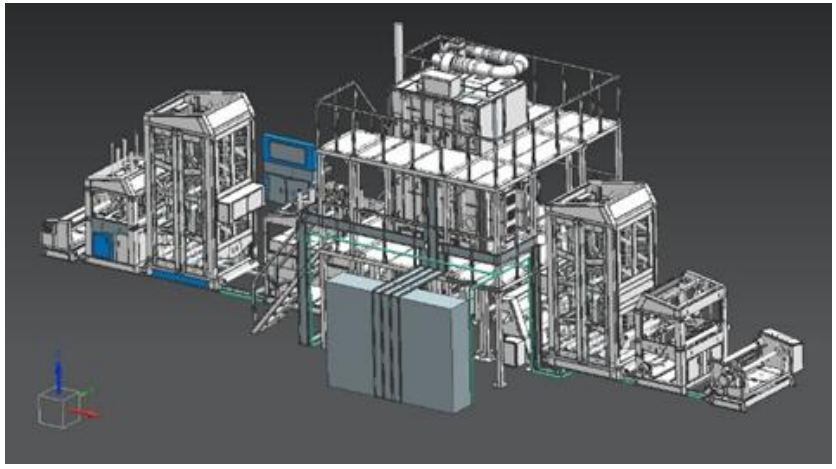
MY ROLE

Machine architecture, mechanical design, motion and safety concept.

KEY METRICS

1	16	Ex d
Continuous line: unwinding → curing	Axes on one EtherCAT clock	Certified explosion-proof





06 • MULTI-AXIS SYNCHRONIZATION

7 synchronized axes at 100 m/min

High-speed film & label laminator · Exported to the EU

PROBLEM

An imported Israeli-built laminator with no documentation, legacy controls and mechanical weak points.

EXECUTION

Reverse-engineered the machine and re-architected it: new Mitsubishi control architecture with 7 synchronized servo axes, custom synchronization program, reinforced mechanics.

RESULT

All KPIs met at 100 m/min and ±2 mm placement; more reliable than the original equipment; commissioned and exported to a client in the EU.

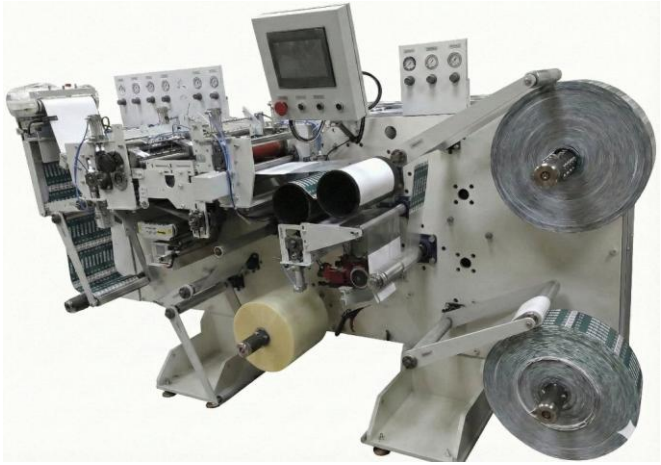
MY ROLE

Lead engineer: reverse-engineering, mechanical upgrade, control architecture, commissioning.

KEY METRICS

0	100 m/min	EU
Pages of original documentation	Line speed, 7 axes	Exported to an EU client

VIDEO Watch it run ↗





07 • SPEED TO PRODUCTION

Blank page to serial production in 2 weeks

COVID-19 response · Slitter-rewinder for non-woven materials · Serial product

PROBLEM

COVID-19, 2020: demand for non-woven materials for mask production spiked overnight, supply chains broke, and no processing equipment was available on the market.

EXECUTION

A serial slitter-rewinder designed only around components with short lead times: load-cell tension control, pneumatic brake, expansion shafts, photo-sensor edge control, modular unwinders for jumbo rolls.

RESULT

From blank page to serial production in two weeks. 18 units manufactured and delivered to mask producers during the pandemic.

MY ROLE

Product owner and lead engineer: design, prototype, series launch.

KEY METRICS

2 weeks	18	100 m/min
Blank page → serial production	Units delivered	Line speed, 1,600 mm web

VIDEO Watch it run ↗



Nuclear plant equipment, proven in simulation

Structural, thermal & seismic FEA · Siemens NX CAE

PROBLEM

Nuclear plant equipment must be proven under peak loads, thermal gradients and design-basis earthquakes before it is allowed on site. Physical testing is often impossible.

EXECUTION

Structural, thermal and dynamic seismic FEA in Siemens NX CAE: meshing, boundary conditions, load cases, thermal-structural coupling and code-compliance reports.

RESULT

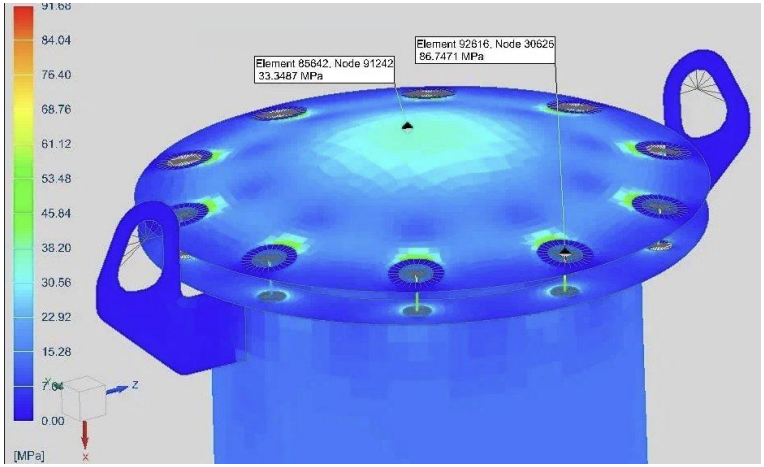
Full technical certification packages that passed the expert review of the plant's lead design authority.

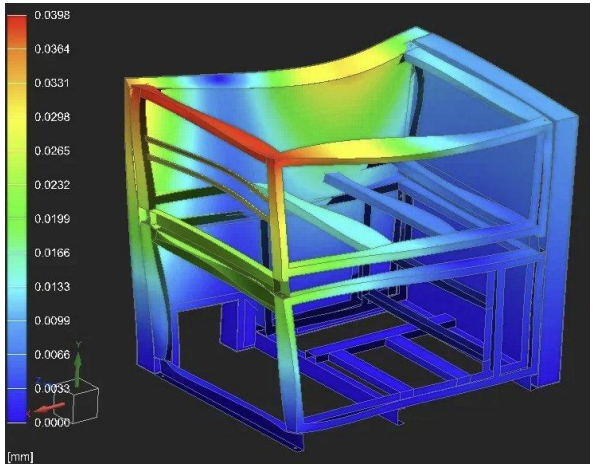
MY ROLE

Principal engineer and FEA analyst.

KEY METRICS

3	Cat. I	Passed
Load domains: structural · thermal · seismic	Seismic safety category	Lead design authority review





ALSO DELIVERED

Designed and built by me. Running 24/7 in production.



Robotic assembly line
DKC
6 → 1 operators · 15 s cycle



Tube processing & assembly
Ariston Thermo Group
3 → 1 operators · 10 s cycle



Cable-gland insertion cell
DKC
4 → 1 operators · 3 box sizes



Modular assembly conveyor
DKC
1 unit every 2–3 s



Membrane vacuum presses
Medical & composites
+500% throughput



Vacuum infusion station
Serial product · aerospace
20 mbar · 28 m³/h



Vertical form-fill-seal machine
Serial product
Automatic screw dosing · up to 20 bags/min



2-component dosing & mixing
Serial product
Epoxy, silicone, PU · 10–60 L/min

WORK WITH ME

From blank page to a working product.

NDA before the first technical call. All files and IP are yours. I support manufacturing and commissioning remotely, or on site when needed.

01 Call
20 min: your product, its risks, what you need.

02 Requirements
Function, environment, budget, volume.

03 Proposal
Pre-design calculations, price, timeline, spec.

04 Contract
Fixed price, fixed deadline. Design starts.

05 Design approval
You approve the 3D model and solution.

06 DFM package
Drawings, 3D CAD, parts list, vendors.

R&D SPRINT

From 4 weeks • blank page → DFM package

Kinematics, system architecture, production-ready CAD and drawings, parts list, vendors, cost, DFM review.

From $10,000

Fixed price and deadline in the proposal

FRACTIONAL HEAD OF ENGINEERING

2–3 days per week • monthly

Hardware roadmap, design reviews, manufacturing and vendor decisions, engineering hiring.

On request

6 years as CEO/CTO of my own engineering company, 4 years as lead engineer before that

TECHNICAL DUE DILIGENCE

For hardware investors • per company

Architecture and manufacturability review, cost, risk and timeline assessment, written red-flag report.

On request

50+ systems across 10+ industries: I know where hardware breaks

I don’t sell drawings. I sell a product that gets built and works.

Building hardware that has to work outside the lab?

Let’s talk. You leave the first call with the 3 biggest production risks in your design.

Book a 20-min call →

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