Sébastien Guerif

MECHANICAL DESIGN ENGINEER PORTFOLIO

OMNIDIRECTIONAL TREADMILL - BLUEGOJI

Sept. 2024 – May 2025

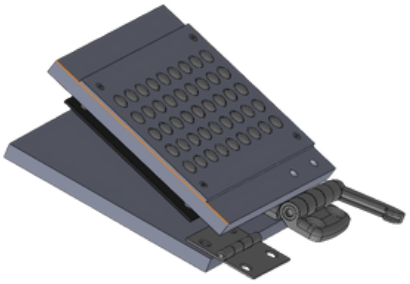
Context:
Design an omnidirectional surface with a user-focused approach to enable a gamified fitness experience.

Objectives:

- Allow omnidirectional movement without motor actuation.
- Prototype and validate through testing, simulation, and user feedback.
- Reinvent the user fitness and gaming experience.

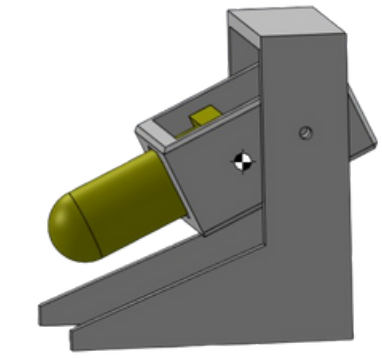
Process:

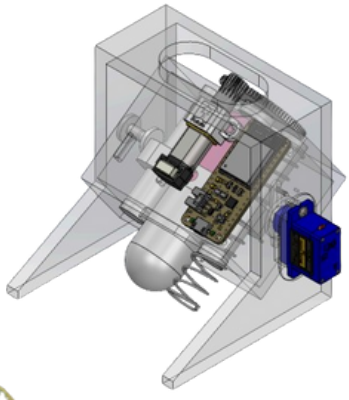
- Researched and analyzed treadmill and braking systems to generate innovative ideas, strengthening synthesis and problem-solving skills.
- Applied Agile methodology and product design tools (PUGH, Gantt) to efficiently select the most effective prototype within the given timeframe.
- Iterated on CAD designs and SolidWorks simulations, enhancing expertise in DFA and DFM.
- Developed and tested brake prototypes, refining performance through cross-functional collaboration

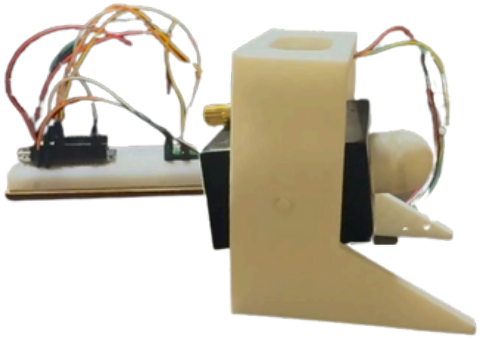


TRAJECTORY JUMPER - UC BERKELEY

Sept. 2024 – Dec. 2024







Objective:
Design a spring-powered jumping system capable of executing precise leaps through hoops.

Process:

- Identified physically impossible jump angles through Kinematics, Dynamics.
- CAD improvements on SolidWorks to optimize weight and assembly.
- MATLAB/Simulink simulations to enhance jump angle/ spring compression relationship.
- 3D-printed components and assembled a functional jumper mechanism.

Results:

- Achieved precise jump trajectory simulations with an error margin of ±0.2m.
- Despite precise calculations, the system did not take off because off a low engine torque and the springs stiffness.

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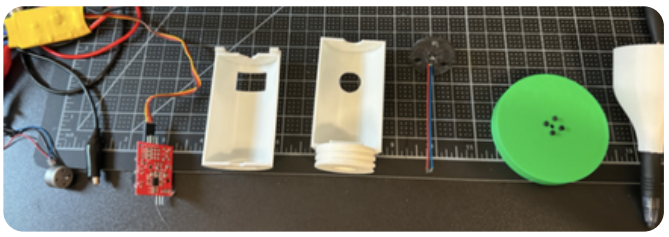
ASSISTIVE WRITING DEVICE FOR HAND TREMORS

Sept. 2024 – Dec. 2024



Objective:
Design an assistive pen using Human-Centered Design principles to stabilize hand tremors, optimizing ergonomics, weight distribution, and user experience.

Process:

- Conducted stakeholder interviews to identify user needs, enhancing communication efficiency.
- Led collaborative ideation phase, applied problem-solving and design thinking skills, resulting in gyroscopic stabilization.
- Developed physics models utilizing Free Body Diagrams for accurate analysis.
- Performed iterative prototype development, refining gyroscop parameters: motor, weight, materials.
- Presented findings at the Jacob Winter 2024 Design Showcase, UC Berkeley.

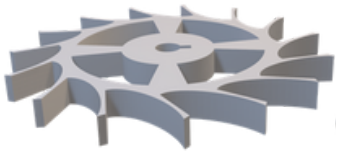
MECHANICAL WATCH - ARTS ET METIERS

Jan. 2024 – May 2024

Objective:
Design a mechanical watch mechanism from scratch and develop a functional prototype.

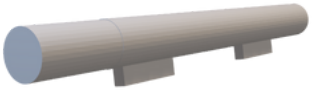
Process:

- Scientific documentation built on a mechanical watch, enhancing technical and report writting.
- Applied DFM/DFA, performed calculations, 3D CAD modeling in CATIA V5, and COMSOL simulations.
- 3D-printed parts (PLA, PETG) and developed a 5-turn barrel system.
- Assembled components, identified precision issues, and iterated using an agile approach.



Results:

- Independent operation of individual components, thanks to effective CAD.
- Frequency simulation on the pendulum (3.8 Hz) close to real-world performance (3.58 Hz)
- Minor play affecting precision, but still within acceptable range, due to 3D printing.
- Hands-on experience gained during the final assembly of all parts



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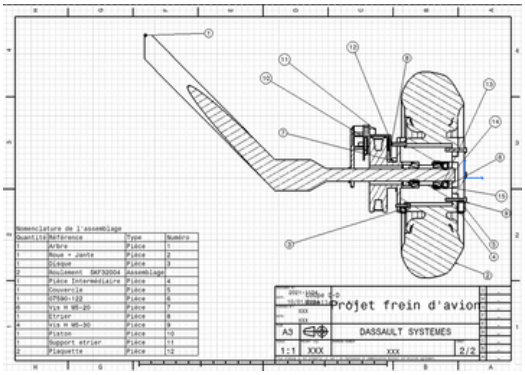
MECHANICAL DESIGN ENGINEER PORTFOLIO

LIGHT AIRCRAFT BRAKING SYSTEM

Arts et Métiers

Sep. 2022 – Jan. 2023

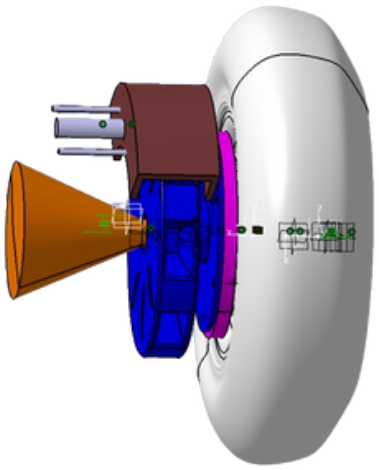


Objectives:

- Design aircraft brakes with mobile calipers.
- Generate the technical drawings with GD&T of the parts and assembly.

Process:

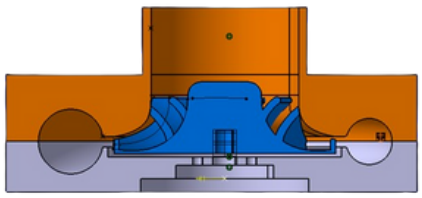
- Conceived a feasible and mountable design using DFM and DFA skills.
- Parts sizing using dynamics and screw tightening calculation.
- CAD on CATIA V5, generated ISO-compliant drawings, improving design standardization, technical documentation skills

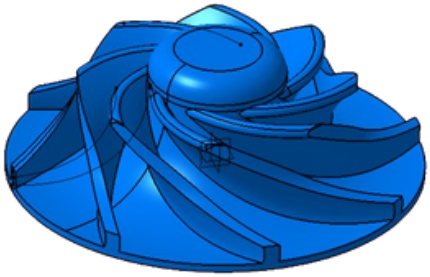


TURBOCHARGER FOR TOYOTA MIRAI FUEL CELLS

Sep. 2023 – Dec. 2023

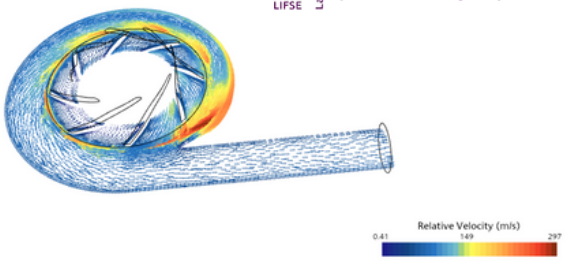
Arts et Métiers





Ingénierie des Fluides Systèmes Énergétiques

LIFSE Laboratoire



Objectives:

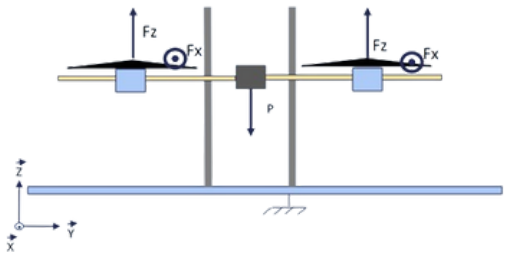
- Design a centrifugal compressor tailored for the fuel cells of the TOYOTA Mirai.
- Assess performance via CFD and wind tunnel experimentation.

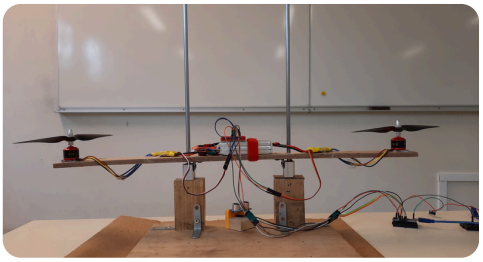
Process:

- Enhanced the impeller efficiency using a Genetic Algorithm optimization program on Python.
- CAD in CATIA V5 using Generative Shape Design, CFD in COMSOL Multiphysics.
- 3D printed a PLA/ABS prototype, efficiency measured by input-output pressure comparison = 0.65, strengthening skills in additive manufacturing and performance analysis.

DRONE BY THRUST AXIS - NEWTON INSTITUTE

Jan. 2022 – June 2022





Objective:
Design and implement a precise vertical positioning control system for a drone.

Process:

- Built a brushless motor model with PyMecavideo; designed a closed-loop control using Scilab/Xcos.
- Integrated a phase lead controller using Bode diagram, ran simulations on Scilab, and conducted experiments to
- Achieved stable altitude control, meeting accuracy (<5% error) and response