Stella (Seokyung) Oh

Mechanical Engineering | Mechatronics | Energy & Environment

Engineering Portfolio

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Contents

Introduction

Profile/ Professional Highlights/ Core Competencies/ Contact Info

Introduction

Stella (Seokyung) Oh

Bachelor of Applied Science with Honors

Mechanical Engineering, University of Toronto

- *Specialization: Energy & Environment, Mechatronics*
- *Minor: Sustainable Energy*

" Mechanical engineer with experience in system-level simulation, experimental validation, and manufacturing-focused process improvement. Skilled in CAD, analytical modeling, and Lean Six Sigma methodologies to support reliable, real-world engineering solutions. "

Professional Highlights

- "IKO North America – Process Engineering Intern (2025–Present)"

  Manufacturing Engineering, Process & Quality Audits, Lean Six Sigma (DMAIC), Root Cause Analysis, Kaizen

"KAIST – Powertrain Optimization Intern (2023 – 2024)"

R&D, Aerospace Engineering , Computer- Aided Engineering (CAE), Engine Simulation (GT-Suite)

- "KAIST – Battery Research Intern (2022)"

  R&D, Automotive Engineering , Lithium-ion Batteries, MATLAB, LCA, Testing, Origin, Data Analysis

Core Competencies

- Collaboration & Leadership
- Design & CAD (SolidWorks, Fusion 360, GD&T, Prototyping)
- Process Improvement (DOE, Lean Six Sigma, DMAIC)
- Simulation & Modeling (MATLAB, GT-Power, Minitab)
- Sustainability & Research

Contact info

- Email: ohseokyung1219@gmail.com
- Tel: +1-437-433-3429

Selected Engineering Projects

R&D/ Design/ Simulation/ Manufacturing & Process Improvement

Section 1.

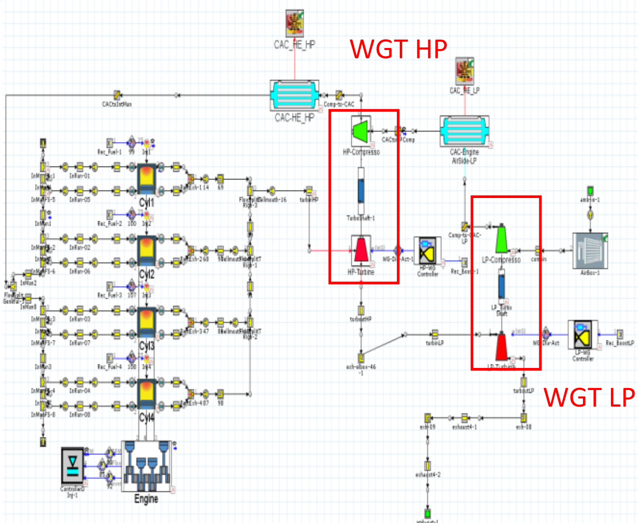
Research & Development

Research projects in powertrain optimization, energy systems, and simulation

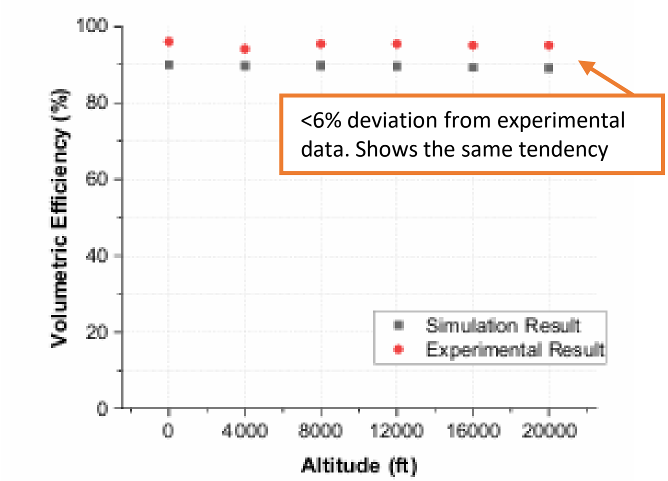
Project : Powertrain Optimization using 1D simulation

Future Transport Power Lab, Powertrain Optimization Research Intern

Duration :	Sep 2023 – Aug 2024
Collaborators :	8 total, in collaboration with *Hanwha Aerospace, BorgWarner, Tenergy*
Overview :	Optimized turbocharged diesel engine under high-altitude conditions by defining turbocharger limits and improving output under reduced air density.



<2 Stage Turbocharger System Simulation Model>



<Validation Using Experimental Results>

Key Actions

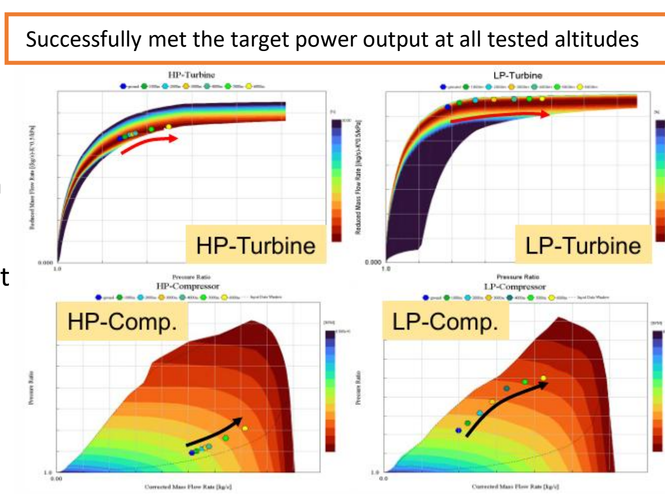
- Calibrated 1D engine simulation models using real-world experimental data.
- Simulated high-altitude performance of a Hyundai diesel engine with a two-stage turbocharger in GT-Power/Suite.
- Analyzed turbocharger boosting strategies for turbocharger efficiency, output, and fuel use, ensuring compliance with emissions standards.
- Delivered technical findings and performance optimization proposals to industrial partners.

Key Results

- Demonstrated that two-stage turbocharging maintains the target power at target altitude (NDA).
- Validated simulation results with <6% deviation from test data.
- ~ 10% power drop vs sea level, stable performance at altitude.

Reflection

- Learned the value of experimental feedback and the importance of patience and precision in real-world model calibration.



<2 Stage Turbocharger Turbine & Compressor Efficiency Maps>

Project : Lithium-ion Battery Analysis

Future Transport Power Lab, Battery Research Intern

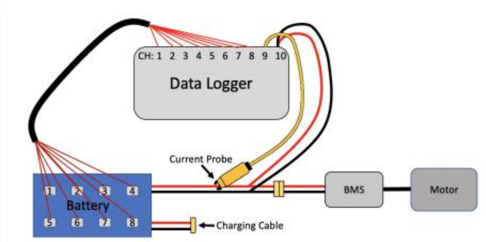
Duration : May 2022 – Aug 2022

Collaborators : Team of 3

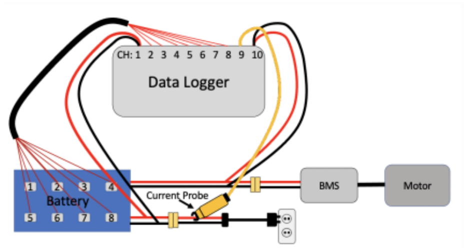
Overview : Analyzed electric scooter battery performance under real-world and controlled tests, evaluating efficiency, thermal behavior, and CO_2 emissions.

Key Actions

- Monitored battery temperature with thermocouples and thermal imaging.
- Built custom charge/discharge setups with integrated data logging.
- Performed chassis dynamometer and real-road driving tests under varied conditions.
- Repeated experiments across multiple temperatures to assess durability.
- Processed efficiency and CO_2 emissions data using MATLAB.



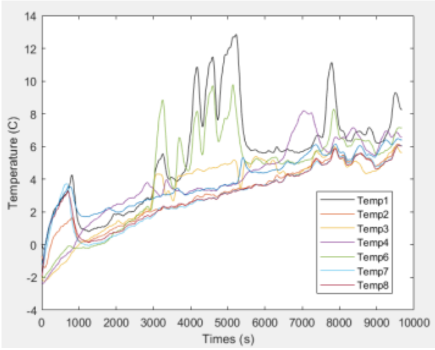
<Discharge Experimental Setup>



<Charge Experimental Setup>

Key Results

- Analyzed battery and motor performance under real and controlled conditions.
- Identified higher ambient temperatures improved efficiency and reduced CO_2 emissions due to reduced internal resistance.
- Measured ~95.5% average charge/discharge efficiency.
- Detected localized heating near the BMS, highlighting thermal risk.



<MATLAB Data Processing>

<Thermal Imaging Camera >

<Chassis Dynamometer Test>

Reflection

- Repeated testing in both lab and real-world settings highlighted the importance of iteration and showed how small environmental factors can significantly affect EV performance.

Tool Used: Microsoft Office | Thermal Imaging Camera | Data Logger | Mechanical Tools | ORIGIN

Section 2.
Mechanical Design & Prototyping

Practical design and prototyping with GD&T, FMEA, and DOE methods

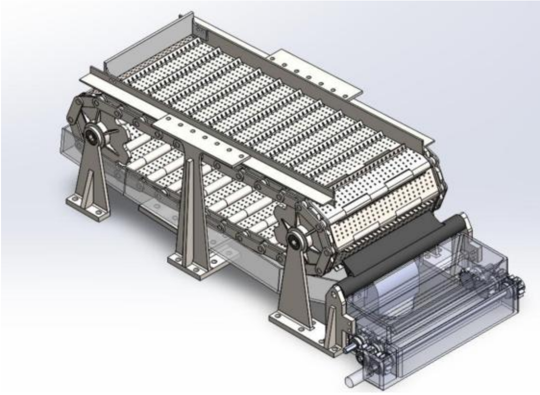
Mechanical Design & Prototyping

Project : At-Source Waste Transportation & Separation System

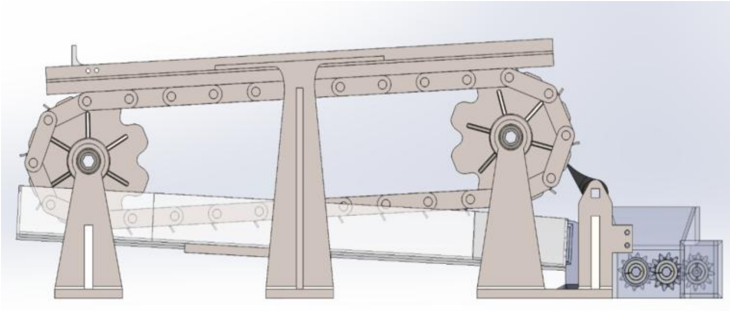
Duration : Sep 2023 – Aug 2024

Collaborators : Team of 4, in collaboration with *Sankoya Technologies*

Overview : Designed a retrofittable system to filter and transport solid waste with minimal agitation, ensure compatibility with traditional toilets, and integrate with Sankoya's treatment process.



<3D CAD of the Design>



<Side View of 3D CAD>

Key Actions

- Designed a retrofittable toilet system to separate and transport waste with minimal agitation.
- Modeled a custom macerator in SolidWorks for effective preprocessing.
- Built and tested prototypes using 3D printing and surrogate waste materials.
- Created detailed part drawings with GD&T for client deliverables.

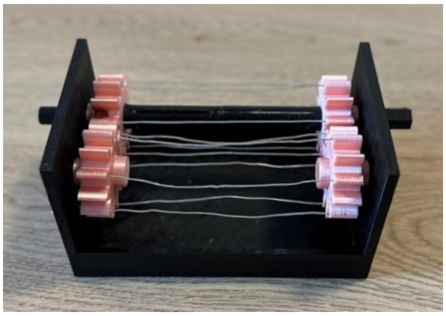
Key Results

- Successfully designed a system compatible with traditional toilets and Sankoya's treatment unit.
- Demonstrated efficient waste separation and preprocessing through prototype testing.
- Improved downstream treatment efficiency by reducing waste size and agitation.
- Delivered functional prototypes and CAD models for client validation.

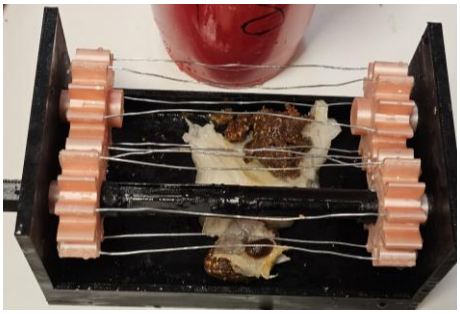
Reflection

- Gained experience balancing design trade-offs and refining solutions through iterative prototyping and testing.

<Prototyped Conveyor>



<Prototyped Macerator>



<Testing>

Project : Spring-loaded Ball Launcher

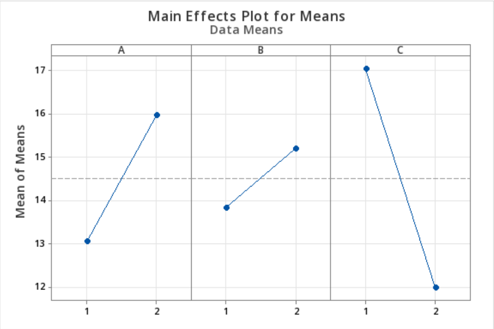
Duration : Jan 2025 – Apr 2025

Collaborators : Team of 6

Overview : Designed and built a mechanical system capable of consistently launching ping pong balls into a target bucket at adjustable distances (10–20 ft), focusing on system reliability, safety, and production optimization.

Design FMEA - Subsystem/Component													
Product Name: Spring Loaded Ball Launcher		**Prepared By**: Group 18											
Date: Feb 3rd, 2025	**Revision Level**: A	Design Responsibility:											
										Revised Values			
Item Function	**Potential Failure Mode**	**Potential Causes/ Mechanism of Failure**	**Probability of Severity (1-8 Scale)**	**Probability of Occurrence (1-8 Scale)**	**Probability of Detection (1-8 Scale)**	**Risk Priority Number (RPN)**	**Current Design Control**	**Recommended Actions**	**Owner/ Target Date**	S	O	D	RPN
Barrel: shoots ping-pong balls into the bucket	Barrel Deformation	User abuse: wrong size ball used, wrong loading technique	8	4	6	192	User manual specifying the operational protocal and included standard size ping-pong balls	Reinforce barrel	Y.W. Feb.18, 2025	8	2	5	80
Gearbox: adjusts the barrel angle	Gearbox Jammed	Excessive force applied by users causes gears to seize	8	5	4	160	Gears can withstand higher load so less affected by user abuse	Add lubricants to assist smooth operation	S.L. Feb.20, 2025	8	3	3	72
	Gear deterioration	Gear tooth can be broken or worn-out by excessive rotations	6	4	7	168	None	Use nylon gears to be more abrasion resistant	C.D. Feb.15, 2025	6	3	5	90
	Gear Backlash	Poor manufacturing tolerances	5	7	3	105	Design gears with larger tooth number	Smaller tolerances for gear	C.D. Feb.18, 2025	5	4	3	60
		Tooth wear overtime	5	6	3	126	None	Add lubricants to assist smooth operation	S.O. Feb.25, 2025	5	3	3	45
Spring: Propulsion source to accelerates the ping pong ball	Spring Jamming	Dust Contamination	8	4	7	224	Spring compartment enclosed	Specify in user manual to avoid using in dusty environments	S.O. Feb.15, 2025	8	3	5	120
	Spring Misalignment	Improper Installation	7	2	7	98	Added a spring rentention shaft to fix the position of spring	Use expandable shafts to make sure it covers the entire length of the spring	YW March.12, 2025	7	1	3	21
	Spring Breakage	User abuse	8	2	4	64	Used High Carbon Steel Music Wire to withstand user abuse	Use DOE to determine best material that is durable	R.Y. March 6, 2025	8	2	2	32
	Spring buckling	Spring retention shaft failure	6	4	7	168	Added fillet to avoid stress concentration	Conduct FEA analysis on overall product structure	E.G. March.18, 2025	6	2	1	12
	Spring fatigue	Cyclical loading	6	3	8	144	None	Spring replacement after 10000 cycles ≈ 100 cycles of operation	S.L. Feb.20, 2025	6	3	3	54
	Spring corrosion	Corrosion from moisture exposure Temperature fluctuations causing metal stress Chemical exposure	5	3	8	120	User manual specifying service environment	Use DOE to test and select materials that are corrosion resistant	R.Y. Feb.25, 2025	5	3	3	45
Trigger: To release the launch pad	Trigger locking flanges getting sheared off	High spring load to the launch platform causing the flanges in the trigger to shear	8	4	3	96	Added fillet to avoid stress concentration	Conduct FEA analysis on the structure	E.G. Feb.10, 2025	8	3	1	24
Lauch height adjustment platform: To adjust the launch height	Height blocks collapsed	User put too much force to compress the spring, causing the launch platform to be broken	3	7	1	21	None	User manual warning the potential failures	E.G. April.04, 2025	2	5	1	10

<FMEA Table>



<Design of Experiments (DOE)>

Key Actions

- Prototyped the launcher with adjustable pitch and modular barrels using SolidWorks and 3D printing.
- Created a Product Functional Diagram (PFD) to map subsystem behavior and input–output relationships.
- Conducted Failure Modes and Effects Analysis (FMEA) to mitigate mechanical risks.
- Ran a full-factorial DOE in Minitab to assess main and interaction effects.
- Performed a Taguchi DOE (L4) with noise factors (new vs. worn ping pong balls).

<3D CAD of the Design>

Key Results

- Identified key performance drivers through DOE, improving consistency.
- Enhanced the launcher's safety, robustness, and repeatability.
- Delivered a validated prototype supported by DOE data and tolerance analysis.
- Strengthened system reliability by addressing mechanical risks identified through FMEA.

<Testing the Spring-loaded Ball Launcher>

Reflection

- Learned to combine prototyping with data-driven methods for reliable design decisions.

Tool Used: Microsoft Office | SolidWorks | 3D Printing | Prototyping | Minitab | FMEA | Design of Experiment (DOE)

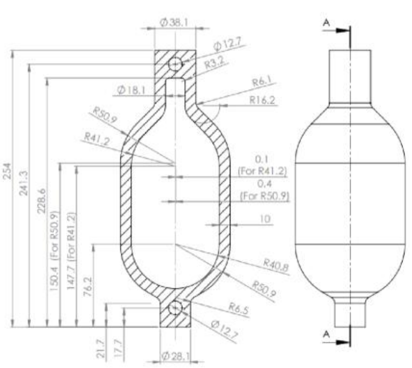
Section 3.

Simulation & Analysis

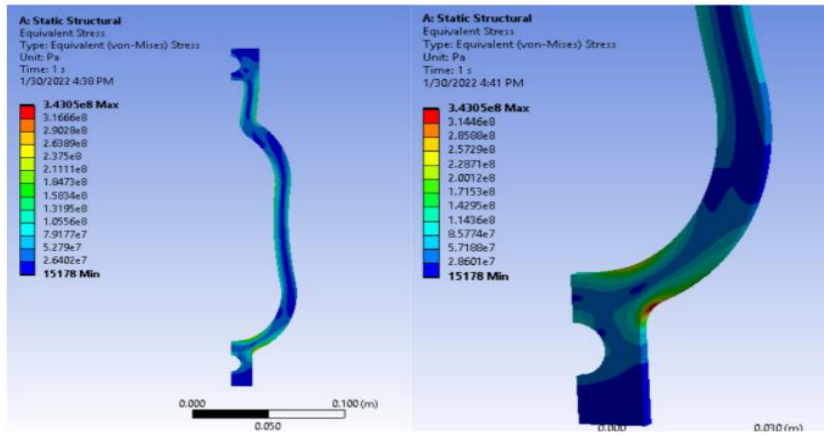
Analytical studies using FEA, CFD, and computational modeling

Project : Pressure Vessel Stress Analysis

Duration :	Jan 2022 – Apr 2022
Collaborators :	Team of 4
Overview :	Investigated the failure mechanism of a fractured aluminum 6061-T6 pressure vessel using analytical, numerical, and experimental techniques.



<Engineering Drawing of Pressure Vessel>



<Finite Element Analysis>

Key Actions

- Performed tensile tests to determine Young's Modulus (70.48 GPa), Poisson's ratio (0.353), and yield/ultimate stresses (218 MPa / 310 MPa).
- Conducted strain gauge experiments (uniaxial & rosette) under incremental loading (0.25–0.75 kN) to map strain distribution.
- Applied Finite Element Analysis (ANSYS) with Von Mises criterion to simulate stress fields and predict critical failure loads.
- Cross-validated experimental tensile/strain data with FEA results for accuracy.

<Strain Guage Testing>

Key Results

- Identified stress concentration at the lower exterior fillet, consistent with strain gauge and FEA results.
- Validated FEA predictions with experimental data (<10% deviation).
- Estimated critical failure load ≈ 400 N, confirming numerical and physical results.
- Strengthened understanding of integrating mechanical testing and FEA for structural failure analysis.

Reflection

- Learned how to integrate mechanical testing with FEA to cross-validate results and improve confidence in failure predictions.

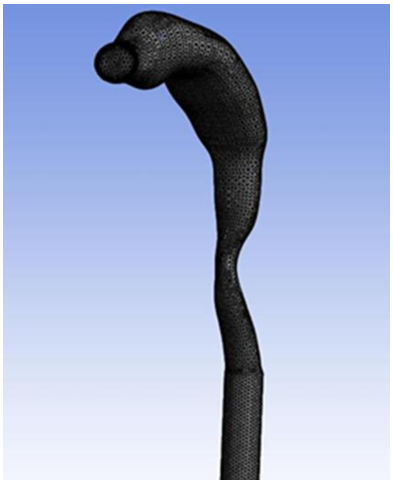
Project : Upper Airway Inhaler Flow Simulation

Duration : Sep 2024 – Jan 2025

Overview : Analyzed airflow dynamics and drug particle deposition in the upper airway using CFD, conducting mesh sensitivity and convergence studies to evaluate inhaler performance, improve delivery efficiency, and identify critical deposition regions.

Key Actions

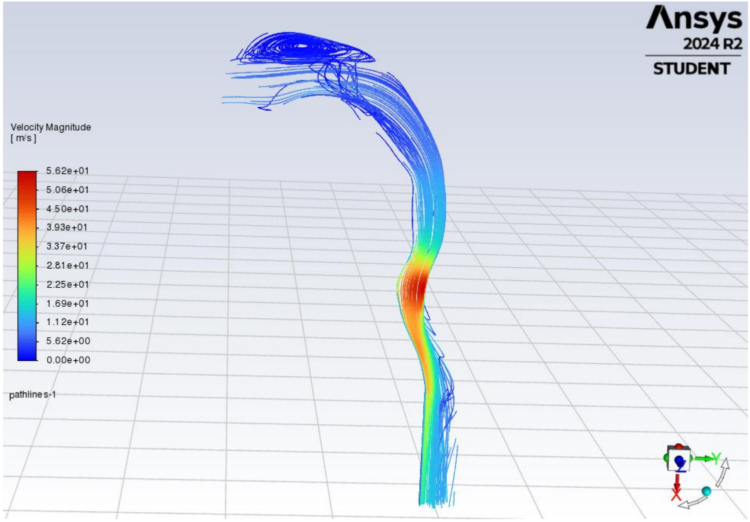
- Simulated airflow in an upper airway model using ANSYS Fluent.
- Performed mesh independence study by varying inflation layers.
- Applied Discrete Phase Model (DPM) to analyze particle deposition.



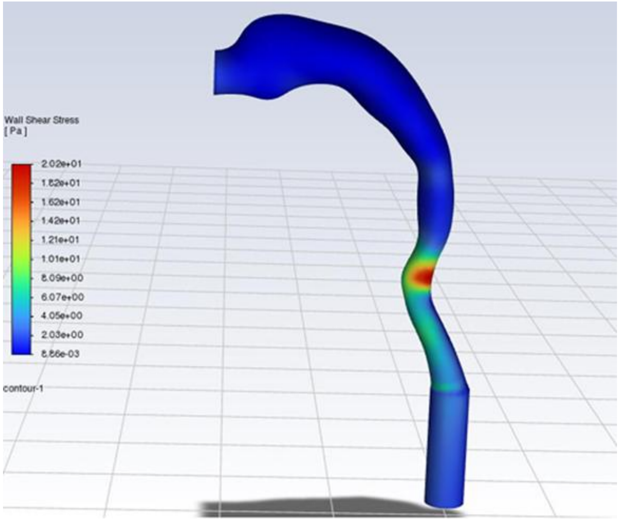
<Mesh>

Key Results

- Achieved mesh-independent solution with 8 inflation layers (Δ<0.015).
- Identified recirculation zones and vortices at airway bends, affecting airflow distribution.
- Particle deposition increased from 5.5% to 43% as flow rate rose.
- Smaller particles (2 µm) mostly escaped, while larger particles (7 µm) showed higher deposition.



<Velocity Streamline Plot>



<Shear Stress Contour Plot>

Reflection

- Learned the importance of mesh quality and convergence studies for reliable CFD results.
- Understood how flow conditions and particle size significantly influence deposition in biomedical systems.
- Strengthened ability to connect numerical simulation insights with real-world inhaler performance.

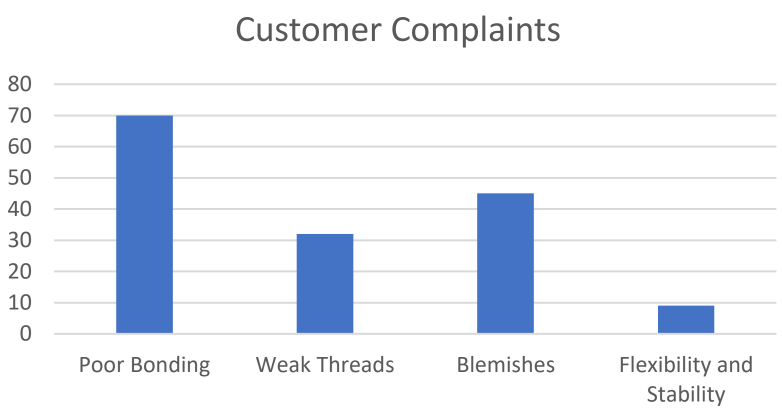
Section 4.
Manufacturing & Process Improvement

Process optimization and defect reduction with DMAIC methodology

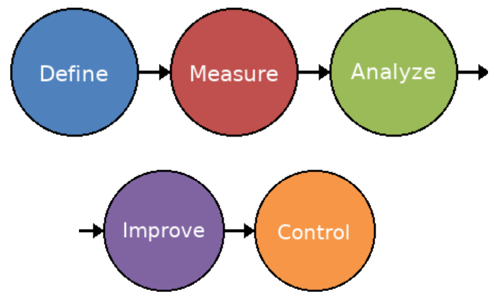
Project : Zoni Footwear – Lean Six Sigma Case Study

Duration : Aug 2025 - Sep 2025

Overview : Applied Lean Six Sigma (DMAIC) to improve the bonding process between shoe uppers and lowers, addressing high defect rates and customer dissatisfaction.



<Ordered Histogram>



<DMAIC Cycle>

Key Actions

- Defined VOC (Voice of Customer), CTQs, and current process inefficiencies.
- Collected measurements on bond strength, cycle time (target 32 min vs. actual 2.3 hrs), and defect rates.
- Conducted root cause analysis using value stream mapping, hypothesis testing, control charts, and regression analysis.
- Identified bonding process as the most critical factor (via XY Matrix).
- Tested alternative adhesives, reduced non-value-added steps, and implemented training interventions.

Key Results

- Reduced process variation, improving bond strength consistency (Leon Plant vs. Guadalajara Plant comparison).
- Lowered cycle time closer to target, with fewer defects (DPMO ~156 → 2.5σ, improvement plan to reach 4σ).
- Identified COPQ (Cost of Poor Quality) impact from returns and lost customers.
- Recommended multi-variable improvements: process re-engineering, better materials, operator training, and formal controls.

Reflection

- Learned how to apply DMAIC tools (CTQ, XY Matrix, DPMO, COPQ, regression) in a real-world business case, strengthening my ability to connect statistical analysis with actionable process improvements.

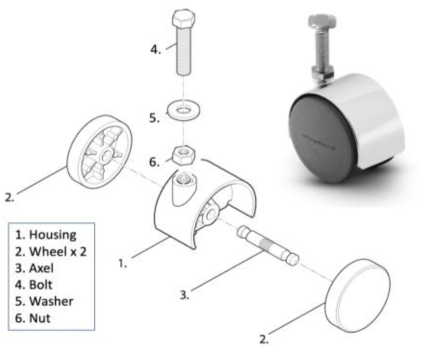
Mechanical Design & Prototyping

Project : Automated Chair-Caster Assembly System Proposal

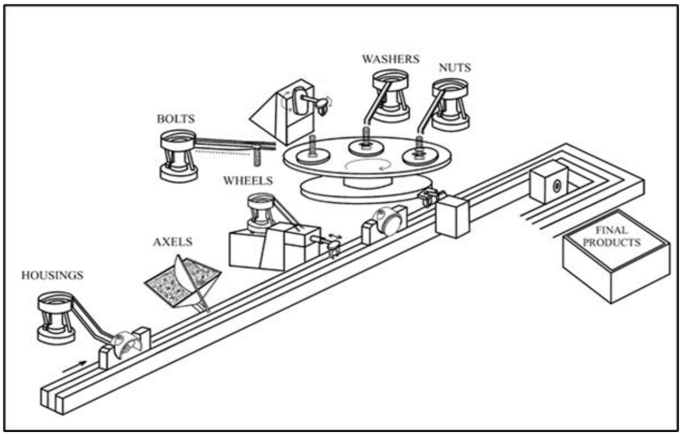
Duration : Jan 2022 – Apr 2022

Collaborators : Team of 5

Overview : Designed a fully automated assembly system for 2-inch double wheel chair casters, integrating feeders, positioners, custom grippers, conveyors, and quality control systems to improve production efficiency and consistency.



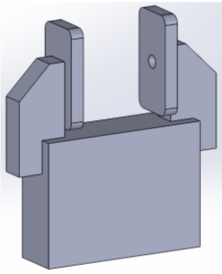
<Chair Caster Assembly>



<Work cell Layout>

Key Actions

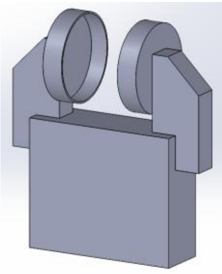
- Proposed vibratory & non-vibratory feeders for part orientation and transfer.
- Designed custom grippers and fixtures for housing, axle, wheels, bolts, washers, and nuts.
- Developed an assembly line layout combining conveyor and rotary indexing table.
- Integrated Robotic screwdriving machine and pneumatic positioners for automation.
- Incorporated quality control checkpoints (vision inspection, displacement sensors, final dimensional checks).



<Custom Finger Gripper>

Key Results

- Delivered a complete proposal for a cost-effective automated work cell ($10.9K–$25.7K).
- Ensured quality through incoming, in-process, and final inspection systems.
- Improved manufacturability by minimizing degrees of freedom in positioner selection.
- Demonstrated feasibility of scalable automation for chair caster production.



<Custom Parallel Gripper>

Reflection

- Learned to design a manufacturing system that balances automation cost, quality control, and process efficiency, strengthening understanding of how theory translates into real-world production systems.

Tool Used: Microsoft Office | SolidWorks | Manufacturing Engineering Methods | Cost Analysis

Achievements

Publications/ Conference/ Certifications

Publications

J. Korean Soc. Aeronaut. Space Sci. 53(3), 291-298(2025)
DOI:https://doi.org/10.5139/JKSAS.2025.53.3.291
ISSN 1225-1348(print), 2287-6871(online)

희박 공기 조건 내 2단 터보차저 디젤 엔진의 저압 터보차저 부스트압 제어전략별 엔진 성능 분석

오서경[1], 김정호[2], 기영민[3], 김도현[4], 배충식[5], 박준수[6], 정재훈[7], 최영묵[8]

Analysis of Engine Performance Based on Low-Pressure Turbocharger Boost Control Strategies of Two-Staged Turbocharged Diesel Engine Under Lean Air Conditions

Seokyung Oh[1], Jungho Justin Kim[2], Youngmin Ki[3], Dohyun Kim[4], Choongsik Bae[5], Junsu Park[6], Jaehoon Cheong[7] and Youngmook Choi[8]
Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea[1-5]
Hwanwha Aerospace, Seongnam, Republic of Korea[6]
Tenergy, Hwaseong, Republic of Korea[7]
BorgWarner, Yongjin, Republic of Korea[8]

ABSTRACT

Due to the high fuel consumption of gas turbine engines used in conventional aircraft, research is actively being conducted in the aviation sector to apply reciprocating engines to reduce fuel consumption and increase flight time. Additionally, it is essential to check the performance under lean air conditions for the aviation application as the density and pressure of the air decrease with increasing altitude. Particularly, the application of turbochargers and establishing boost control strategy is crucial for improving combustion efficiency and ensuring adequate performance under lean air conditions. However, experimental approaches under lean air conditions require significant huge time and costs. Computational simulation can reduce huge testing cost and time than actual engine test at high altitude condition. In this study, we uses GT-Power, 1D simulation tool, to establish low-pressure boost control strategies for a two-staged turbocharged diesel engine system under lean air conditions, analyzing engine performance.

J. Korean Soc. Aeronaut. Space Sci. 53(6), 641-647(2025)
DOI:https://doi.org/10.5139/JKSAS.2025.53.6.641
ISSN 1225-1348(print), 2287-6871(online)

2단 터보차저 장착 디젤 엔진의 고도별 성능 분석

기영민[1], 김정호[2], 오서경[3], 김도현[4], 배충식[5], 박준수[6], 정재훈[7], 최영묵[8]

Performance Analysis of Two-Stage Turbocharged Diesel Engine under Various Altitude Conditions

Youngmin Ki[1], Jungho Justin Kim[2], Seokyung Oh[3], Dohyun Kim[4], Choongsik Bae[5], Junsu Park[6], Jaehoon Cheong[7] and Youngmook Choi[8]
Korea Advanced Institute of Science and Technology, Daejeon, Republic of Korea[1-5]
Hwanwha Aerospace, Seongnam, Republic of Korea[6]
Tenergy, Hwaseong, Republic of Korea[7]
BorgWarner, Pyongtaek, Republic of Korea[8]

ABSTRACT

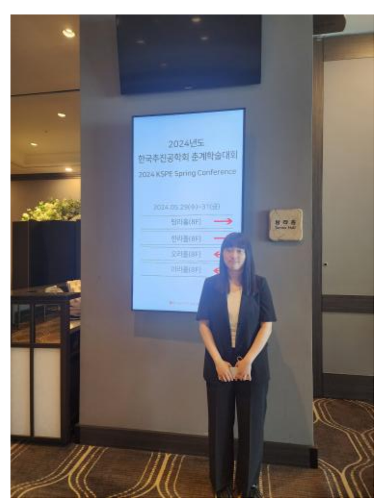
Recent research has been actively exploring the application of reciprocating engines with low fuel consumption rates in aircraft powertrains. Reciprocating engines require a high induction airflow rate to enhance power output; however, at high altitudes, lower air pressure makes lower engine performance. To solve this issue, boost charging is essential. This research analyzes the performance of a diesel engine which is installed with single-stage and two-stage turbochargers. Engine performance at various altitudes was evaluated using 1D simulations and the simulation results were validated using an environmental reproducing chamber. Results indicated that as altitude increased, the single-stage turbocharged diesel engine has reduced boost charging and power output. But, the two-stage turbocharged diesel engine has improved power output by increasing boost charging. Additionally, it was observed that fuel consumption was decreased at lower air temperature in same atmosphere pressure conditions.

Oh, S., Kim, J. J., & Ki, Y. (2025). Analysis of engine performance based on low-pressure turbocharger boost control strategies. J. Korean Soc. Aeronaut. Space Sci., 53(3), 291-298. (SCOPUS, KCI) Ki, Y., Kim, J. J., & Oh, S. (2025).

Performance analysis of two-stage turbocharged diesel engine under various altitude conditions. J. Korean Soc. Aeronaut. Space Sci., 53(6), 641–647. (SCOPUS, KCI)

Conference

- Turbocharger Control Logic for Reciprocating Engine at Mid-Altitude Using 1D Simulation – *Spring 2024 Korean Society of Propulsion Engineers Conference*, Seokyung Oh et al.



Achievements

Certificates

Six Sigma Global Institute

SSGI

This is to certify that

Seokyung Oh

has successfully completed the requirements and demonstrated proficiency in the curriculum established by Six Sigma Global Institute to be awarded the title of

Lean Six Sigma Green Belt Professional

Barry Shore PhD | Chief Learning Officer

August 28, 2025

ID: 159321137

Zachary R. Shore | Managing Director

<Lean Six Sigma Greem Belt Professional>

DASSAULT SYSTEMES

SOLIDWORKS

CERTIFICATE

Dassault Systèmes confers upon

SEOKYUNG OH

the certificate for

Mechanical Design

January 17 2022

Academic exam at University of Toronto

Gian Paolo BASSI

CEO SOLIDWORKS

C-W3UHRPFMT2

<Certified SolidWorks Associate in Mechanical Design (CSWA)>

Certificate of Completion

This is to confirm that:

Seokyung Oh

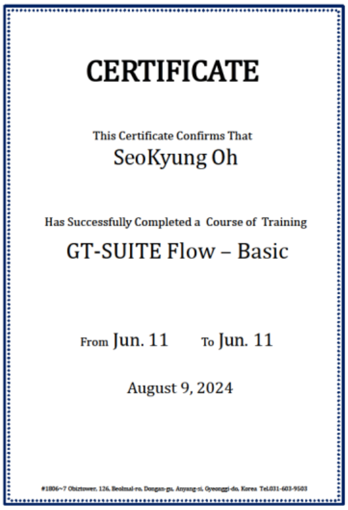
Has successfully completed the Ministry of Labour, Training and Skills Development's training module:

Worker Health and Safety Awareness in 4 Steps

Issued on: July 22, 2025

Ontario

<Worker, Health, and Safety Awareness in 4 Steps>



CERTIFICATE

This Certificate Confirms That

SeoKyung Oh

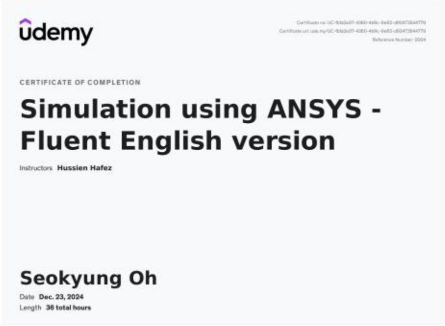
Has Successfully Completed a Course of Training

GT-SUITE Flow – Basic

From Jun. 11 To Jun. 11

August 9, 2024

<GT-Suite Flow>



udemy

CERTIFICATE OF COMPLETION

Simulation using ANSYS - Fluent English version

Instructors Hussien Hafez

Seokyung Oh

Date Dec. 23, 2024

Length 38 total hours

<ANSYS Fluent>

MathWorks | Training Services

Course Completion Certificate

Stella Oh

has successfully completed 100% of the self-paced training course

MATLAB Onramp

DIRECTOR, TRAINING SERVICES

12 July 2025

<MATLAB Onramp>

<Basic Machining – George Brown College>

Value I Bring to Your Team

- CAD, system-level simulation, and prototyping backed by hands-on engineering projects
- R&D experience in powertrain and energy systems with simulation validation and testing
- Lean Six Sigma–driven process improvement and cross-functional collaboration in manufacturing

Contact

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Thank You!