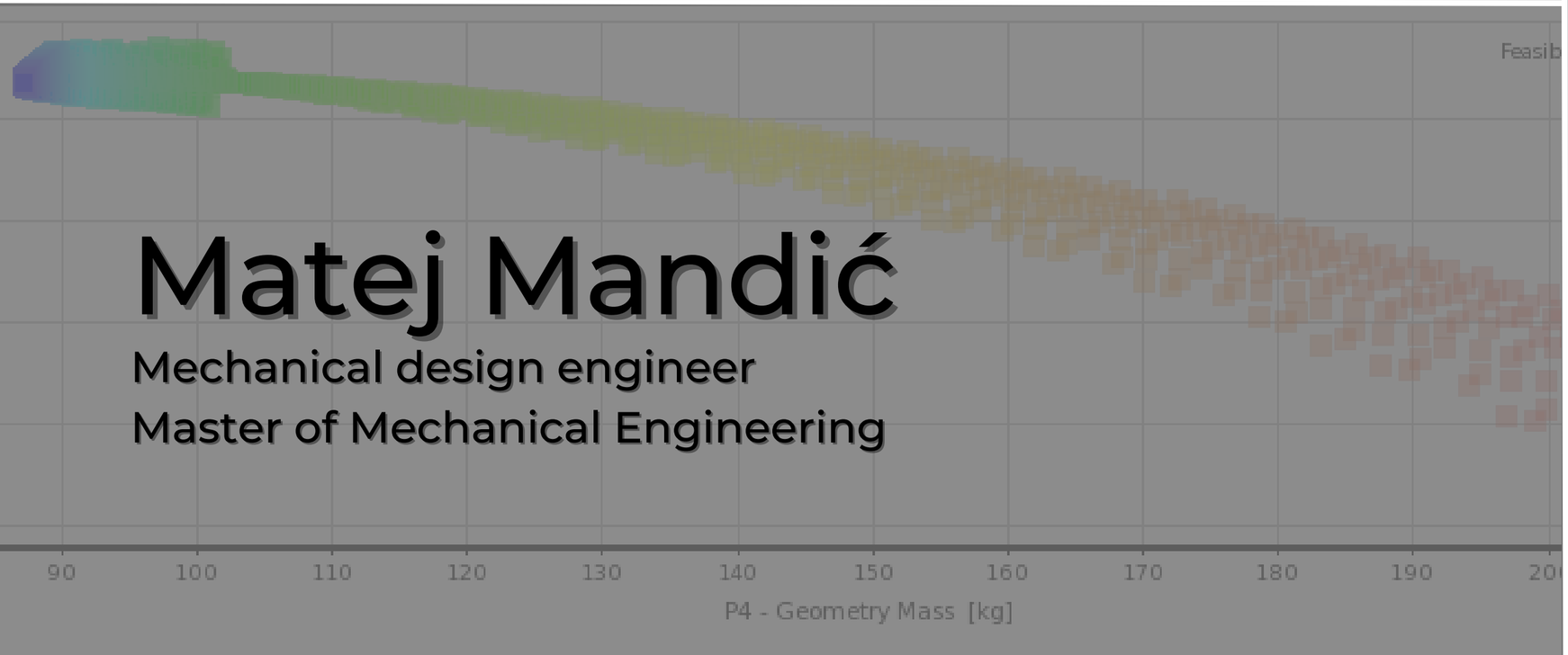
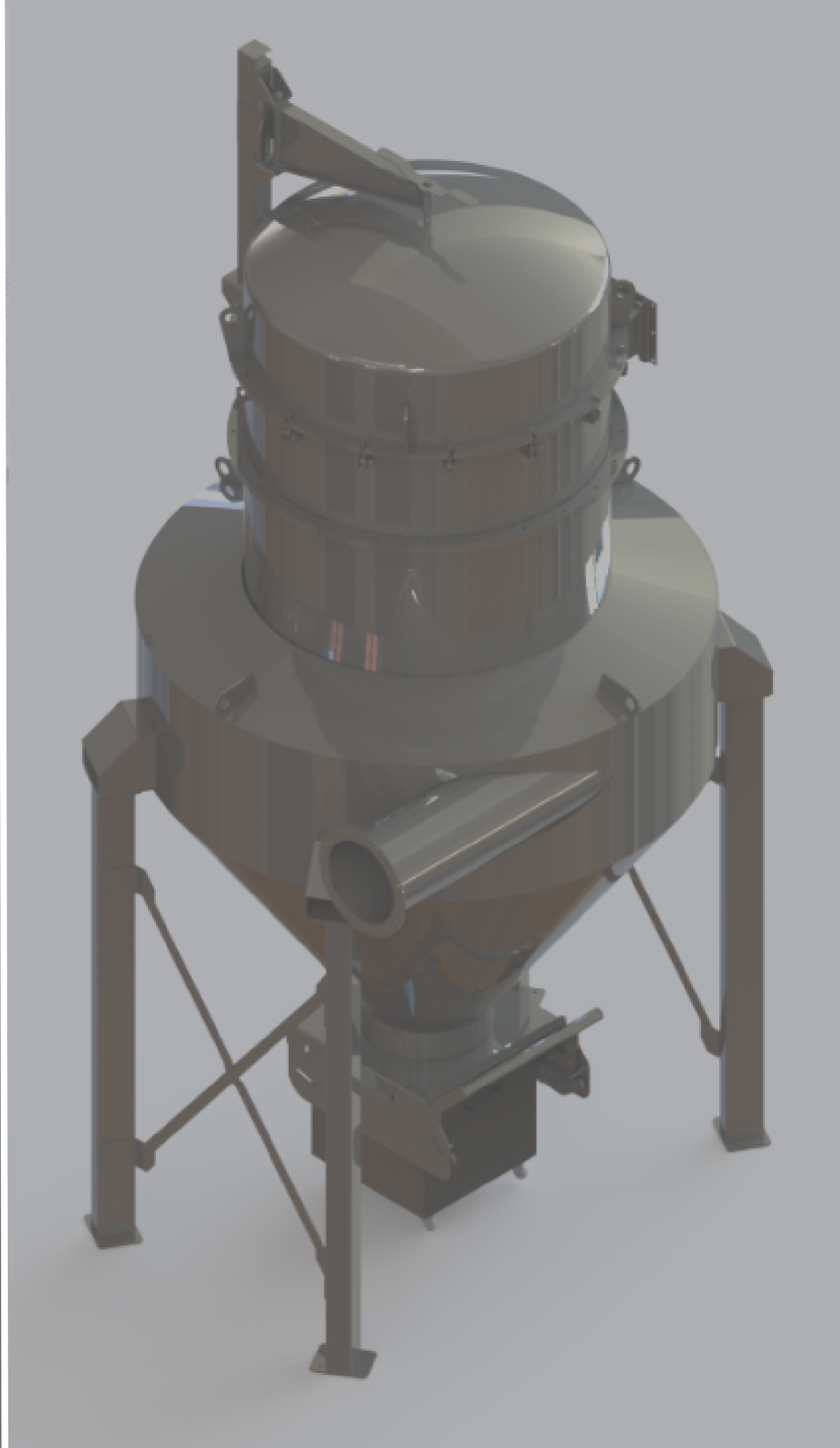
Mechanical design portfolio



Matej Mandić

Mechanical design engineer

Master of Mechanical Engineering



About me

mmandic@newtonianworld.com

Hi!
My name is Matej. I am a mechanical design engineer!

In my CV, I cannot present all my skills, so I would like to share in my mechanical design portfolio some of the exciting projects that I have done over the years.

I did many projects during my professional work, but I could not share all of them with you (NDA). The ones I did share, I hope you will enjoy exploring them, as I was enjoying doing them.

Technology may change rapidly, but people change slowly. The principles [of design] come from the understanding of people. They remain true forever.

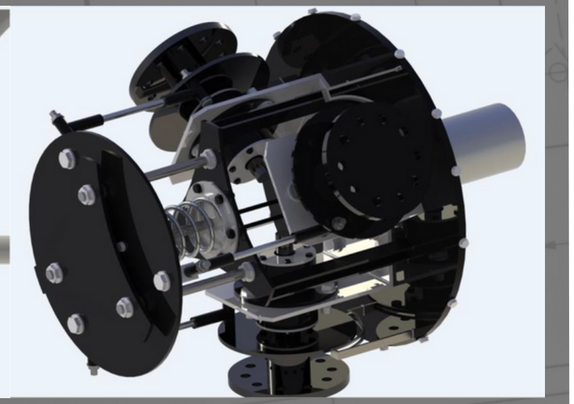
Donald A. Norman

Content

Project: Design of Horizontal wind turbine

- Duration: 6 months
- Software used: SolidWorks, Q - Blade, MS Office (Excel, Word)

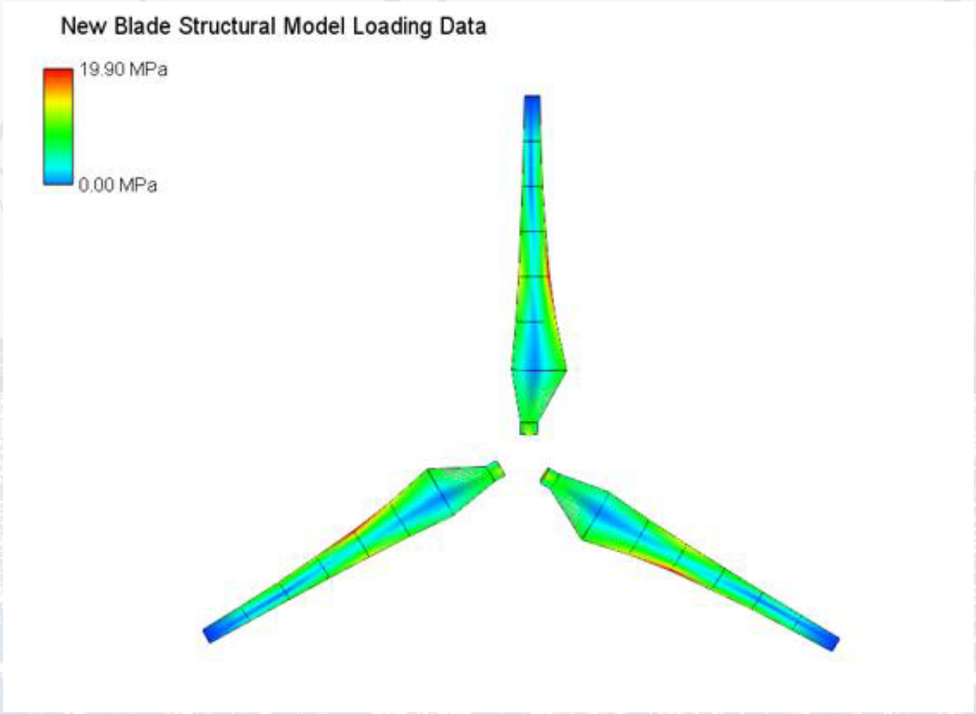
The main goal of this project was to develop and design a horizontal wind turbine with an output power of 5 kW. The whole design was developed from scratch using SolidWorks. Passive regulation with spring was used to adjust the angle of the turbine blades. The model was built with 1290 parts, where generator and the gearbox were shown as “black box”.



Project: Design of Horizontal wind turbine

Turbine blade geometry was calculated manually and strength calculation was performed with software Q – blade.

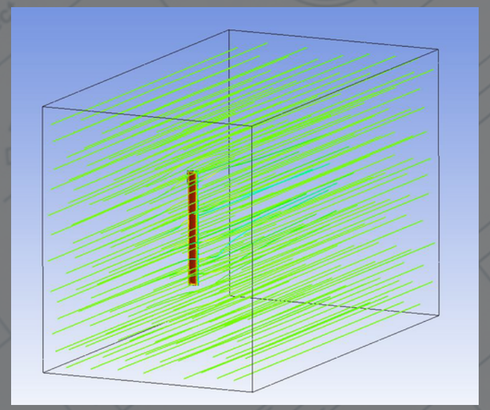
A, m^2	dF_{Di}, N
NACA 4415	
A_1= 0,1228	$dF_{D1} = \frac{1}{2} \cdot \rho \cdot A_1 \cdot w_1^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}1228 \cdot 10{,}7^2 \cdot 0{,}03 = 0{,}24$
A_2= 0,1666	$dF_{D2} = \frac{1}{2} \cdot \rho \cdot A_2 \cdot w_2^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}1666 \cdot 16{,}1^2 \cdot 0{,}03 = 0{,}8$
A_3= 0,1234	$dF_{D3} = \frac{1}{2} \cdot \rho \cdot A_3 \cdot w_3^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}1234 \cdot 21{,}5^2 \cdot 0{,}03 = 0{,}97$
A_4= 0,0974 m^2	$dF_{D4} = \frac{1}{2} \cdot \rho \cdot A_4 \cdot w_4^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}0974 \cdot 27{,}2^2 \cdot 0{,}03 = 1{,}21$
A_5= 0,0786	$dF_{D5} = \frac{1}{2} \cdot \rho \cdot A_5 \cdot w_5^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}0786 \cdot 32{,}9^2 \cdot 0{,}03 = 1{,}43$
NACA 4418	
A_6= 0,0652	$dF_{D6} = \frac{1}{2} \cdot \rho \cdot A_6 \cdot w_6^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}0652 \cdot 38{,}7^2 \cdot 0{,}028 = 1{,}53$
A_7= 0,0568	$dF_{D7} = \frac{1}{2} \cdot \rho \cdot A_7 \cdot w_7^2 \cdot C_D = \frac{1}{2} \cdot 1{,}125 \cdot 0{,}0568 \cdot 44{,}4^2 \cdot 0{,}028 = 1{,}76$

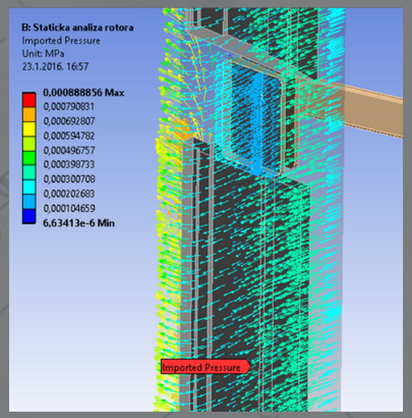


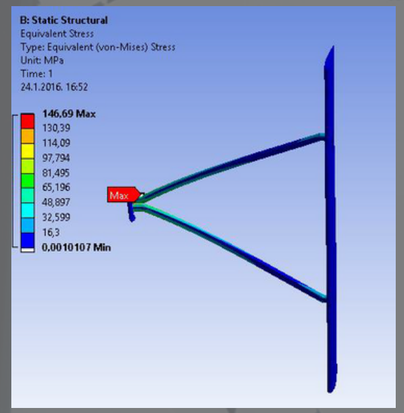
Project: Design and calculation of Vertical wind turbine

- Duration: 6 months
- Software used: SolidWorks, Ansys CFX, Ansys Static Structural, Ansys DesignXplorer, MS Office (Excel, Word)

The main goal of this project was to create an initial design of the vertical wind turbine and to create basic calculations as a basis for further development of the product. After making the first model and calculations, the model was compared with product requirements (technical, business, economic, material, user requirements). Based on this analysis, further models were developed until all the requirements were met.

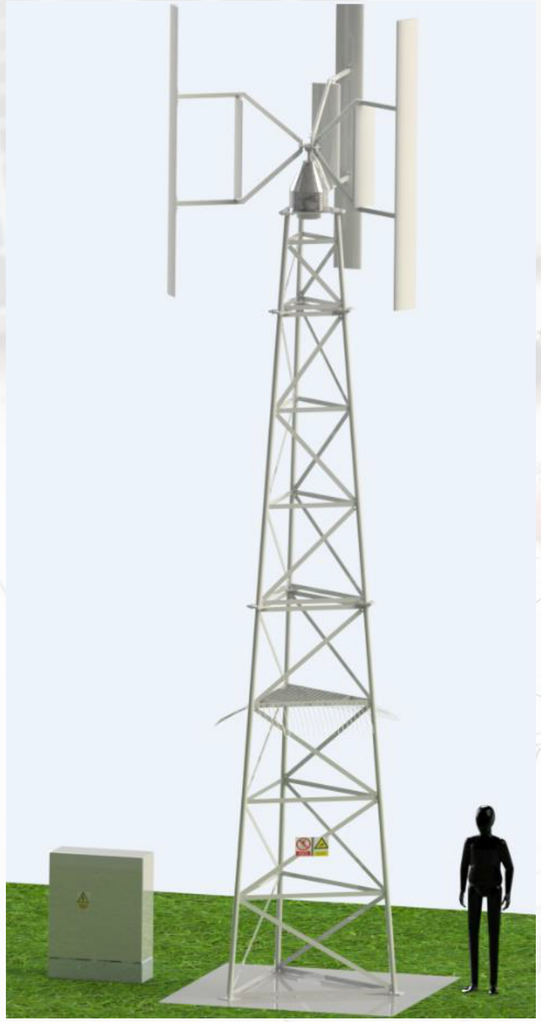


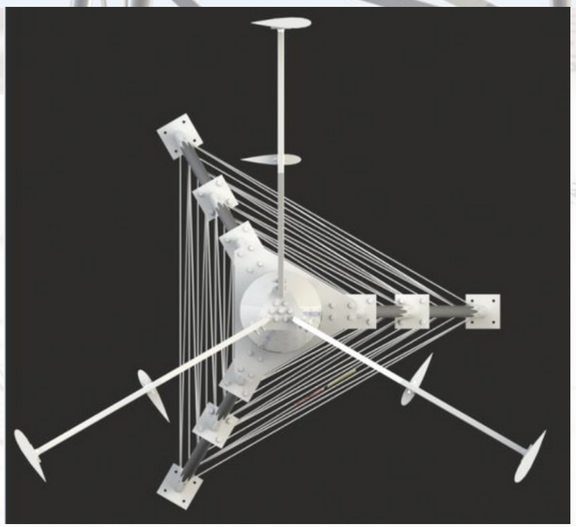


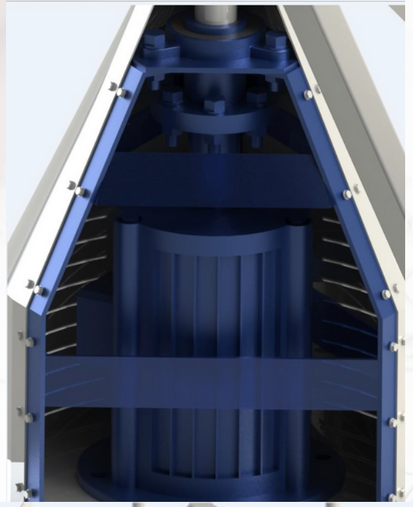


Project: Design and calculation of Vertical wind turbine

Redesigned vertical wind turbine:



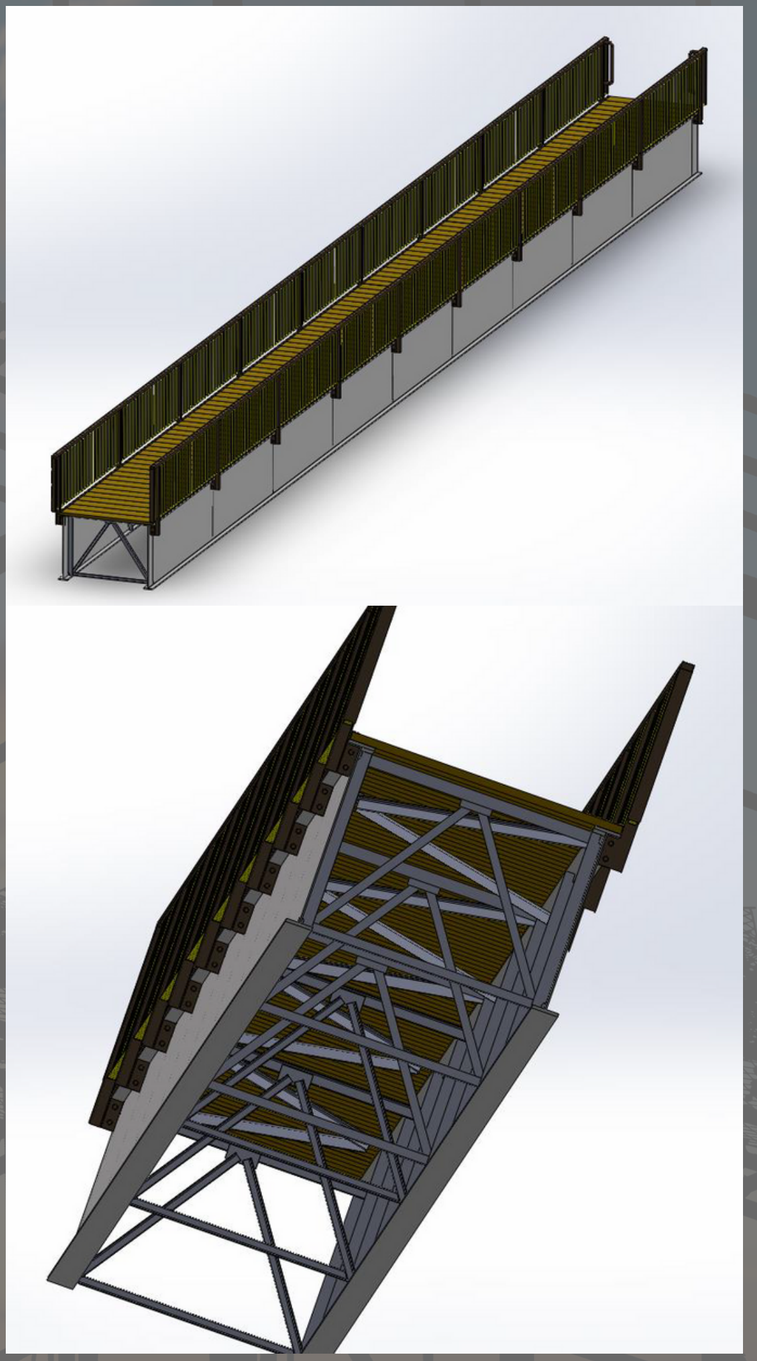




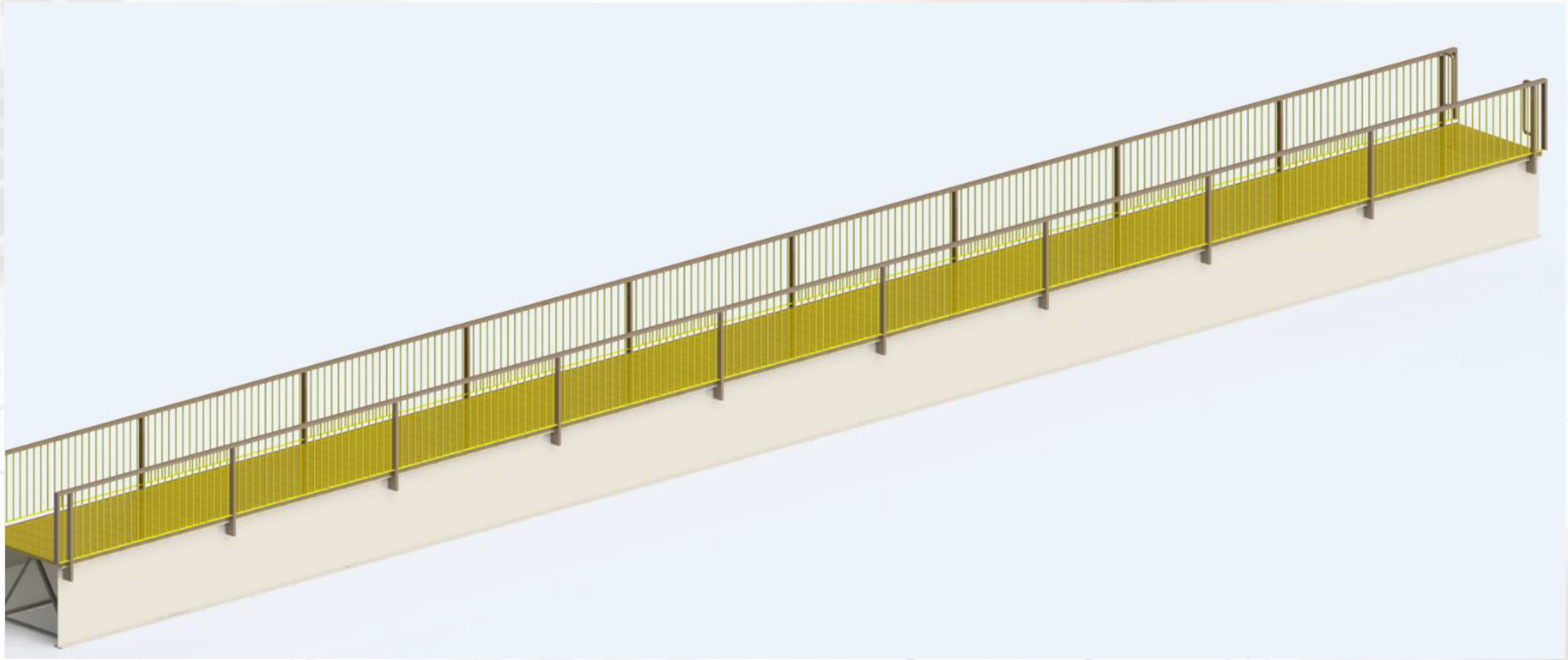
Project: 3D model reconstruction of pedestrian bridge

- Duration: 1 months
- Software used: SolidWorks

The main goal of this project was to get acquainted with the existing solutions for metal constructions. The dimensions of the pedestrian bridge were taken “on-site,” and the 3D model was created based on those dimensions.



Project: 3D model reconstruction of pedestrian bridge



Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis

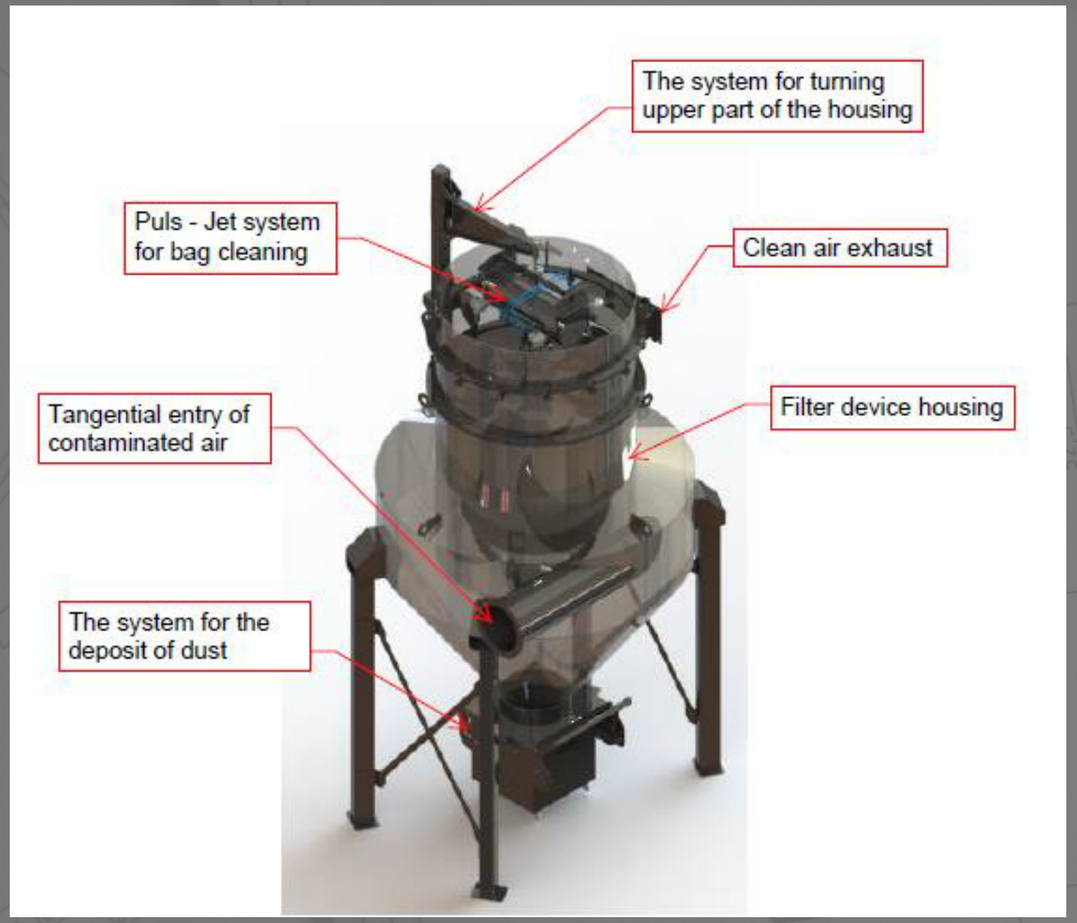
- Duration: 6 months
- Software used: SolidWorks, Ansys CFX, Ansys Static Structural, Ansys DesignXplorer, MS Office (Excel, Word)

The main goal of this project was to design and develop new product line based on the costumer request. The following requirements were defined: cylindrical shape of housing, type of filter: cartridge filter, number of cartridge filters: 4, maximum air flow: 3600 m3/h, sequences of cleaning: continuous sequence of cleaning, method of cleaning cartridges: pulse – jet, air flow direction through bags: external filtration, fan position in relation to the filter device: negative pressure, tangential entry of air through casing, cartridge replacement over the rotating upper turret, implement the existing system for the dust deposition, dust type: metal dust, grinding.

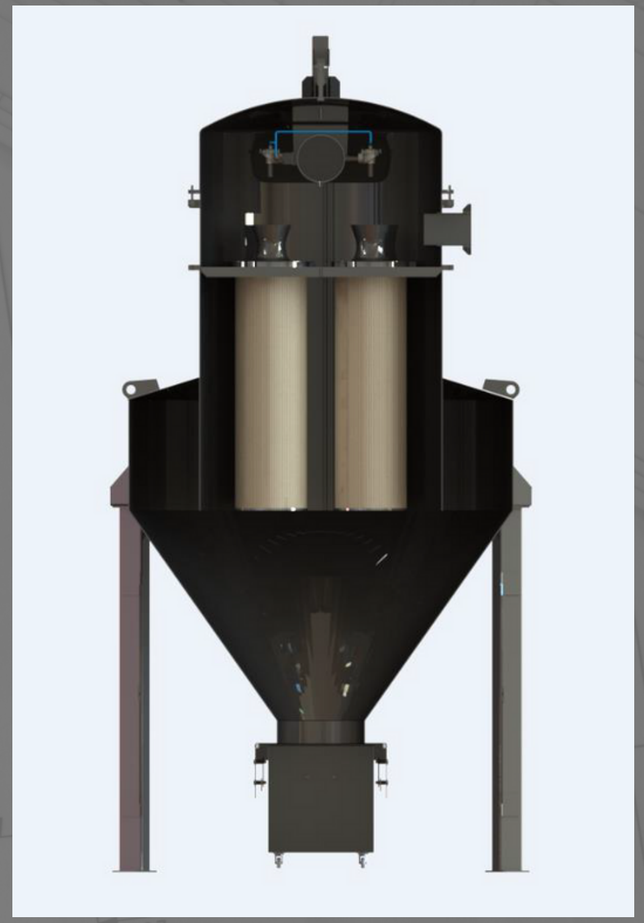
Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis

The model was created with SolidWorks 2016 Premium. Development of the model is time consuming and exhaustive process where with iterative process required product model is achieved. The model was made in several versions; each version is better than the previous.

Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis

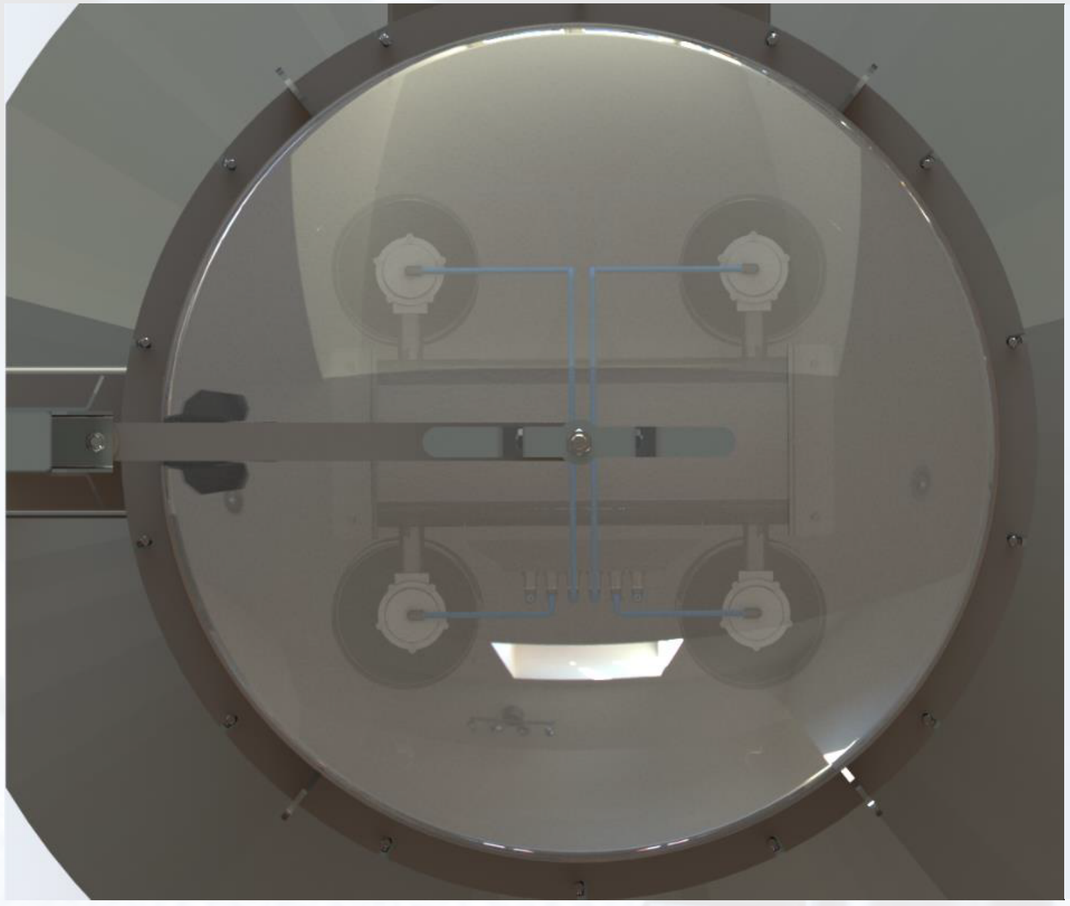


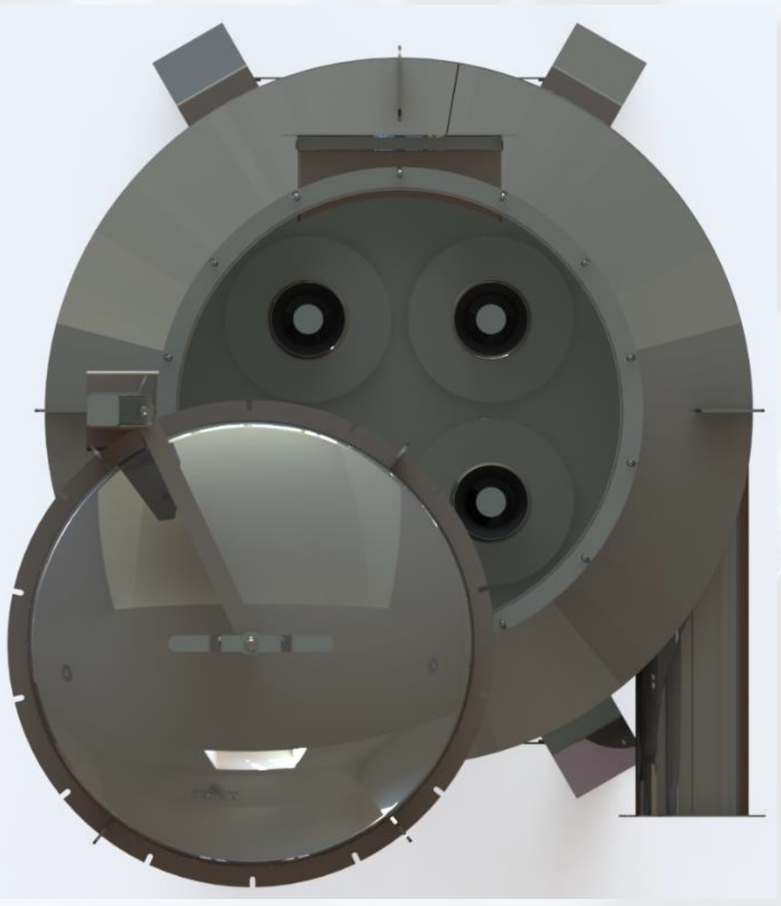
Operating principle of designed filter air device



Cross – section of filter air device

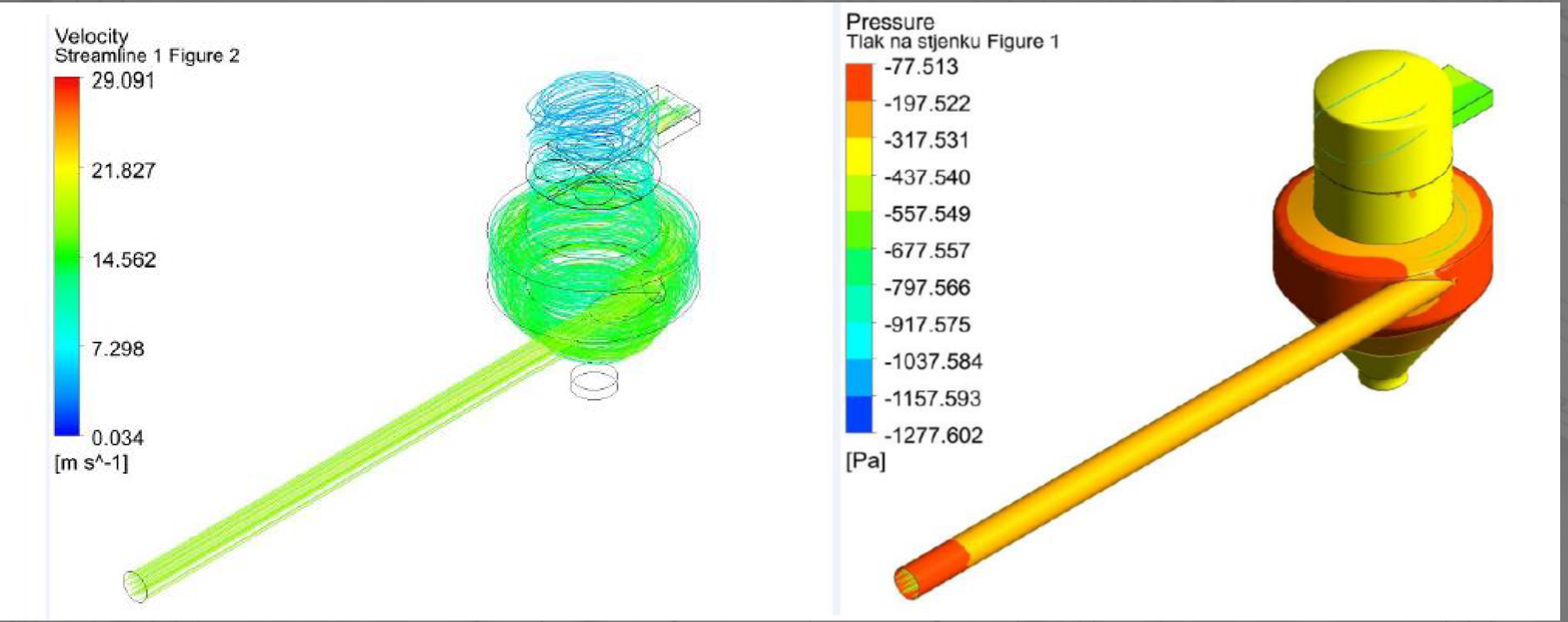
Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis





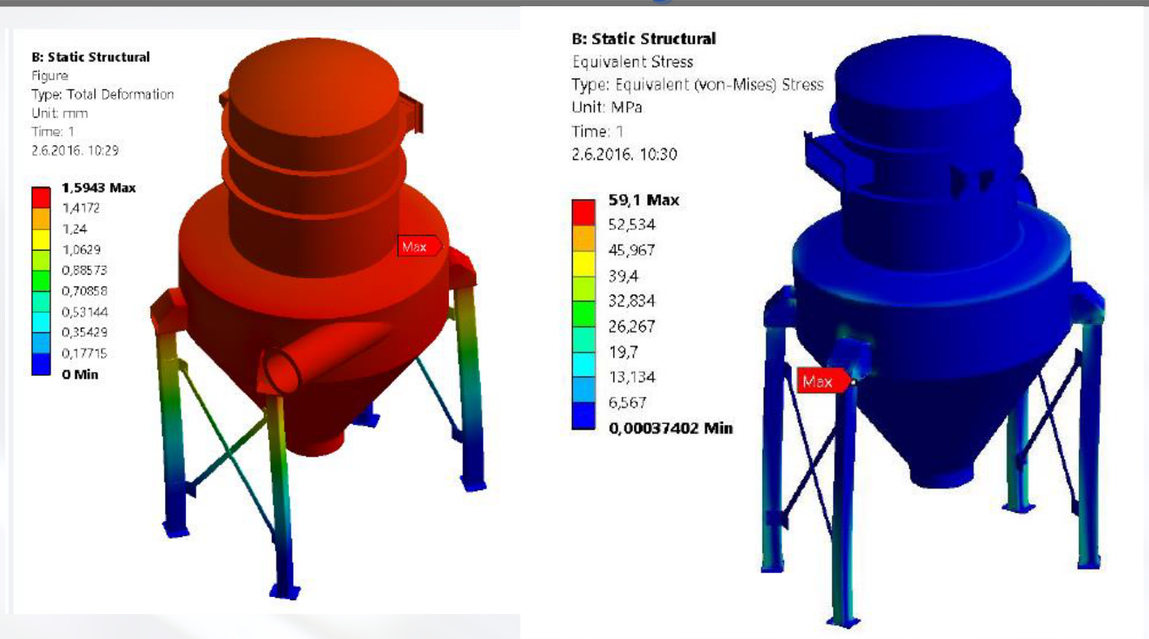
System for turning upper part of the housing

Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis



Velocity streamline (left) and pressure distribution (right) on the filter air device housing

Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis



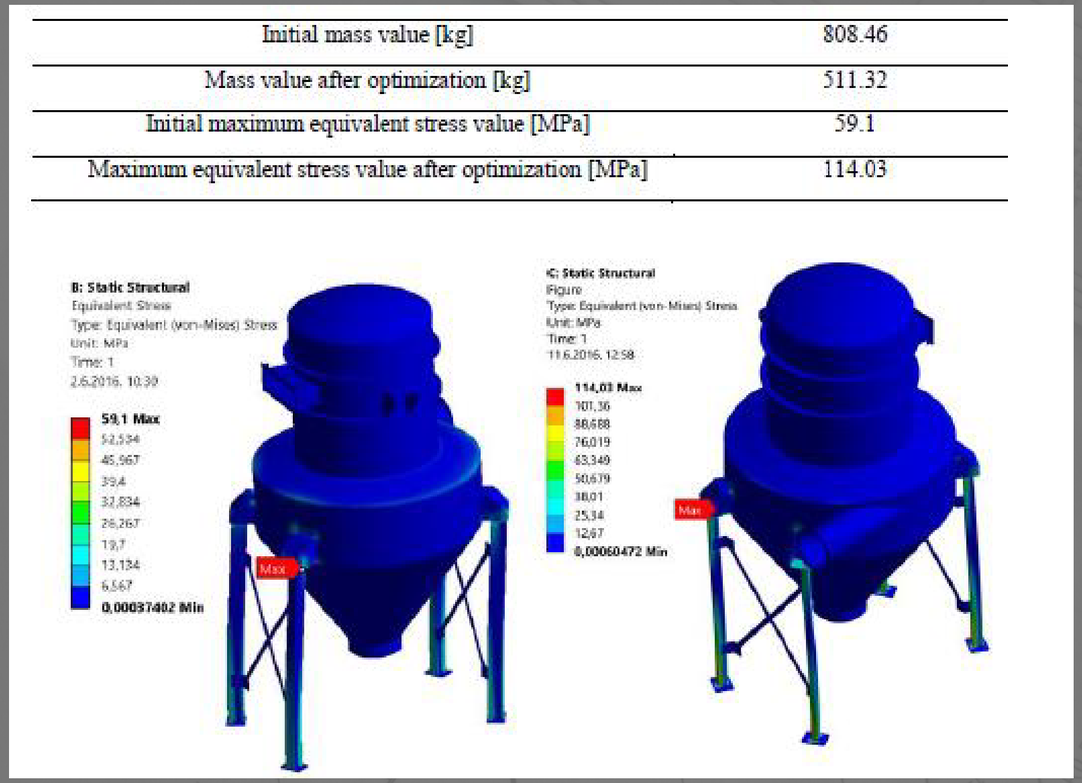
Maximal deformation (left) and maximal equivalent stress (left) for conditions of working pressure

Parameter	P1-DS_P1	P1-DS_P1	P1-DS_P1	P1-DS_P1	P1-DS_P1	P1-DS_P1
Start value [mm]	5	5	120	80	4	8
Optimized value [mm]	3	3	80	50	2	4

Start value and optimized value of input parameters

Project: Design and calculation of cylindrical industrial air filter device with use of CFD analysis

Initial mass value [kg]	808.46
Mass value after optimization [kg]	511.32
Initial maximum equivalent stress value [MPa]	59.1
Maximum equivalent stress value after optimization [MPa]	114.03



Output parameters value before and after optimization. Maximum equivalent stress on starting model (left) and optimized model (right)

This project was published on: TEAM 2016, Proceedings of the 8th International Scientific and Expert Conference, AlumniPress, Trnava, Slovakia, 2016, pp. 124 – 135

Project: Newtonian World - www.newtonianworld.com

- Duration: October 2021 - ongoing
- Software used: Autodesk Fusion 360, ~~Canva, WordPress,~~ Snagit, ~~Inkscape~~, MS Office (Excel, Word, PowerPoint), ~~Google Analytics, Quora, Pinterest~~.

- Exploring and researching potential topics
- Writing articles
- Creating checklists, calculation sheets, etc.
- Picture creation for articles and social media.
- ~~Social media management.~~
- ~~Website design, e-mail marketing, and social media management~~.
- Visual concepts following branding guidelines.
- Project management, timeline, milestones, etc.
- Bookkeeping of all receipts, taxes, income statements, cash flow, cost projections, etc.

- Green items, as a mechanical design engineer, I would mention as something that could be interesting for a hiring manager. I would definitely expand on this topic to give more insight into relevant experience and skills

- Red items, I would probably leave it out, while there is no added value

- Orange items I would add or remove depending on the job posting itself.

Publication: Dimensional accuracy of camera casing models 3D printed on Mcor IRIS: A case study

Mandić, Matej; Galeta, Tomislav; Raos, Pero; Jugović, Valentino.

Advances in Production Engineering & Management, Volume 11, Number 4, pp 324 - 332

Abstract:
The main objective of this research was to determine the deviations and eval-uate the dimensional accuracy of 3D printed camera casing models compared to the original models in the STL format. The study sample consisted of the 3D printed camera casing models and the same models in the STL format. The STL format came from Mcor in a set of sample models shipped with the 3D printer. The models were 3D printed on Mcor IRIS and then scanned with ATOS 3D scanner. A comparison between the scanned and original STL mod-els was made in the GOM Inspect software. The results indicate that the max-imum deviation occurred on the scanned front camera cover and it is 0.82 mm in the direction z. The average deviation of scanned front camera cover is 0.0845 mm and the average deviation of scanned back camera cover is 0.0722 mm. The analysis of the results proves that the three-dimensional printed paper-based parts have the dimensions close to the original CAD models.

Keywords: Additive manufacturing, 3D printing, Mcor IRIS 3D scanning, Accuracy
Equipment used: Mcor IRIS 3D printer, ATOS Compact Scan 3D scanner, Caliper Lux Profil
Software used: Slice-IT, Autodesk Meshmixer, GOM inspect, MS - Office

Publication: The modern process of components development of industrial air filter device

Matej Mandić, Dražan Kozak, Ivica Stršković, Damir Cerin

5th International Congress "DANI INŽENJERA STROJARSTVA", Vodice, Hrvatska, 2017.

Abstract:
In order to reduce environmental pollution and increase the quality of the surrounding area, both the outer and the inner, it is necessary to clean the particulate emissions. The air purity is achieved with proper procedure of working gas particles filtration. The goal of this paper is to show the basic components of the industrial air filter device and to show use of modern tools in the process of developing them. The paper describes the process of structure component development of the industrial air filter device, and on this example shows use of the CAD tools in the component development, stress analysis in CAE tool, analysis of results, optimization of components, components revisions production and 2D drafting. Furthermore, the whole process of component development is accompanied by a file management toll i.e. Cloud. The use of modern tools reduces the time and money needed to develop the new components of industrial air filter devices.

Key words: Industrial air filter device, CAD, CAE, optimization, product development
Software used: SolidWorks, ANSYS Static structural, ANSYS DesignXplorer, Sharepoint, MS - Office

THANK YOU!

NEWTONIAN WORLD

REVOLUTION STARTS WITH KNOWLEDGE!