



Department of Mechatronics Engineering

**MECE 399**

Summer Practice I

**Metal Forming Center of Excellence**

06.08.2019 – 06.09.2019

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Fall 2019-2020

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## **ABSTRACT**

I worked as a trainee in the metallography laboratory of the manufacturing hall of the Metal Forming Center of Excellence. The Center contributes to the development of the industry and academic studies with its valuable devices. With its 15 laboratories and qualified employees, it serves the metal forming sector. During my internship, I actively participated in many activities in the center. I tried to do good work in the center by searching for solutions to the problems given to me, developing product in accordance with the necessity, understanding and working principles of the devices in the field, using software that I was not familiar with, computer aided solid modeling and researching what I did not know. I was an uninformed but enthusiastic apprentice, sometimes a researcher and developer, and sometimes a young engineer who could decide the way to be guided. My most difficult point was not knowing whether I made the right decisions when I was given responsibility. But the exchange of ideas through good communication helped me to relax and to distribute the site of responsibility. I experienced code writing on cnc milling machines and cnc lathes, using software and programming languages I did not know, designing products for a purpose, how solid modeling was obtained outside of computer-aided programs, manufacturing stages, and the progress of academic studies.

## **I. DESCRIPTION OF THE COMPANY**

Metal Forming Center of Excellence briefly MSMM was established in 2010. The Metal Forming Center of Excellence describes its mission and vision as: the main purpose of the center is became a national and internationally recognized research and application center with its laboratories, technical equipment and infrastructure thanks to the cooperation between academia and industry. In this direction, the aim is to realize the production technologies based on knowledge, to produce high-value products, to be able to produce with new and communication materials, to increase efficiency, to develop mini and macro-sized products, to increase the innovation capabilities of our country by providing the necessary research and development activities and to increase its power in the developing competitive environment by creating new markets and products. Since its establishment, it has played a valuable role in disseminating central knowledge through different national and international projects, researches, seminars, workshops and training courses in collaborating with industry and other universities.

Metal Forming Center of Excellence is located at the Atılım University Incek campus in the capital Ankara. The website that provides information about the company is as follows: [atilim.edu.tr/en/msmm](http://atilim.edu.tr/en/msmm).

Metal Forming Center of Excellence supports the metal forming sector with innovative, knowledge-based, applied research, and enables the development of energy-efficient manufacturing technologies, the production of high value-added parts and the shaping of advanced materials. The main capabilities that can be mentioned are: material characterization for simulation, shaping of light metals, improving mold design and service life, theoretical methods, numerical methods, material characterization tests, systematic tests, prototype production and pre-production. The center fulfills these capabilities with its 14 laboratories, advanced technological devices and qualified staff in this laboratory. In addition to what I'm talking about, it provides useful services such as projects, consultancy, training and testing in line with the demands of other companies in the sector.

The Board of Directors of the Metal Forming Center of Excellence is composed of 15 members who continue to work in different companies within the sector and at different universities. The Advisory Board contains many competent names from different corners of the world.

During my internship period, although my workplace was a mechanical characterization laboratory, I had the opportunity to study and experience some applications and to join other laboratories in the center under the supervision of experts.

## II. INTRODUCTION

As a trainee at the Metal Forming Center of Excellence, I was assigned to the manufacturing hall, mechanical characterization laboratory. During the time I was in the center, I had the opportunity to observe and experience different types of studies carried out in different laboratories with the guidance of engineers responsible for other interns. The qualifications of the assignments I had during my internship period were as follows: focusing on the problem that has existed in the center for a while and assisting the solution, assisting the preparation of the suitable ground for a process to be performed according to the customers' request, taking part in the implementation of tests that will contribute to the needs of the materials to be shaped in different sectors. To be able to comprehend the working principles of technological devices used in the center by using computer aided design programs in product development and daily activities.

When I was working as an intern at the center, I already had some knowledge and skills to perform the assignments I was given. First of all, I should be able to prepare the desired designs for the production process by using product development programs. In the mechatronics engineering that I was a student of, I should have been able to make applications in the field by using the contents of electrical and electronics based courses that I took for four semesters. I should have been able to quickly get involved in the work to be done by researching the topics I heard for the first time. I should have been able to associate the programming languages and software used in the center with what I have experienced before, concentrate and use it privately. In addition to the contributions of my branch courses that I took to gain engineering competence, I had to assume an understandable and constructive role in human relations in order to adapt well to the working environment.

In general, I have been able to fulfill these qualifications with the knowledge and skills I have gained so far. I got help from the engineers in the center about the theoretical difficulties and the things I could not comprehend. They both acted as a narrator and explained what I asked and also helped me to take steps by taking a guiding role.

This internship was a good experience for me. I realized that what I could do was a great gain for me and that I should appreciate the value of each lesson. But on the other hand, I realized that all the personal knowledge and skills that I have acquired until this age need to be developed for my awareness. I have decided that my learning process is an action that should not end and that I should use my time as a good engineer while graduating as an

engineer with considerable qualifications to put more on what I have done. In addition, my internship outcomes are as follows: to be able to associate the design with the purpose of preparing a product to the production stage and to develop conceptual design with product development programs, to be able to solve the mechanical or programmatic problem by testing the programming language as described in the manual by comprehending the working principles of the interface for discovering and solving the problem at Mawi Crank press which aims to perform measurement and control operations via the Labview graphical programming language interface, scan the, to scan the objects by optical measurement, to scan objects with optical measurement technique, to be able to write and use code on cnc lathe, to observe the time taken until the molds coming out of cnc milling machine are filled with composite and sent to heating process, I have witnessed the process of obtaining data from academic research in an experiment carried out for the more efficient machining of titanium, which is often used in the construction of aircraft and causes difficulty in the shaping or shaping of tools.

## **2.1. Problem statement**

After the first day I met the internship, we went on a tour in the center. The devices in the mechanical characterization section of the manufacturing hall were introduced roughly, and then placed on cubic tables reserved for us. Following this introduction, I have listed the issues and problems that I have been actively involved in to the interns to work in the process from the first day to the last day. They asked me to deal with the Mawi Crank press, which had not been used for nearly a year and a half because of the problem at the center, which had not yet been discovered, to identify and resolve the problem. The parts produced with Mawi Crank press also add value to the center as it receives orders from abroad. Therefore, it had to be activated. I was asked to design a suitable apparatus with one of the computer aided programs for the fatigue test to be done in the future. We also performed a screening procedure in the measurement laboratory with GOM Atos. The purpose of this screening was to avoid costly procurement of the required part of a valuable device of the center. With the scanning, errors that may occur in the drawing of the part were minimized. Sent to production. The material to be produced was for the use of the center only. It wasn't sold. And finally, I was asked to make a technical drawing of a product produced at the center. Apart from these activities which I have been involved in for a long time, I have been involved in my activities during the day.

During my time at the company, my work distribution varied. During my time at the company, my work distribution varied. Along with the technicians, I was an apprentice trying to write and understand the working principles of Kitigawa cnc lathe, Vtec cnc milling machine and Sodick wire erosion machine. With the drawings and researches that the project development engineer and manufacturing field supervisor wanted me to do, I could create an idea and product in addition to observing. I could also be a practitioner in the tests and procedures of the research engineer. And I was able to carry out the process of product development and design to meet an individual need with small directions.

## **2.2. Tools and techniques used**

Every activity I was involved in had its own requirements and conditions. For example, to be able to use ancillary software for a purpose, to apply the technique that will meet the needs of the work done. In this section I will mention about the programming language, software, hardware and techniques I use.

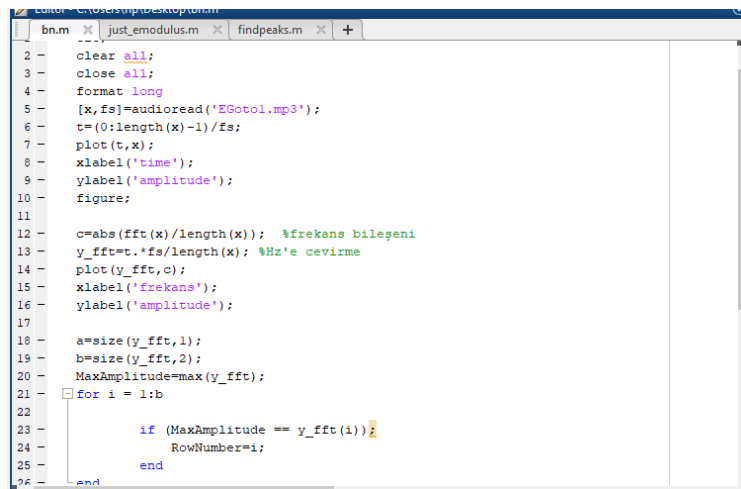


## 2.2.1 Programming languages

### 2.2.1.1. Matlab

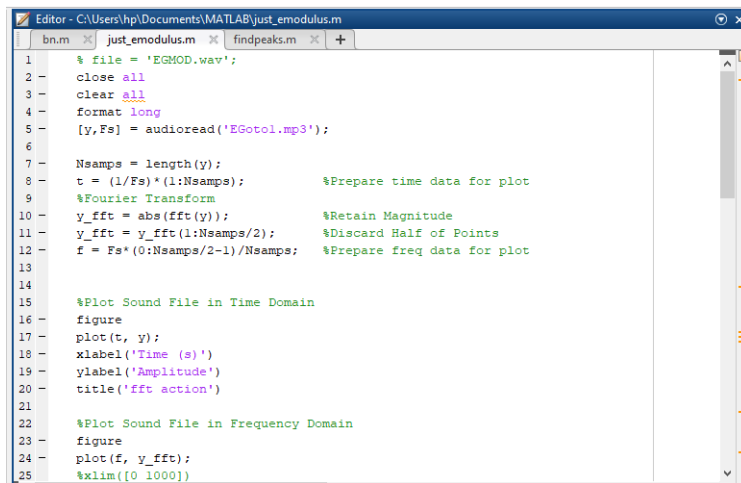
Matlab is a computer program developed by MathWorks for engineering calculations. It is used for the analysis and design of many systems. It has a Matrix-based language. Matlab can be used with C programming language. It can perform many mathematical operations and can be used in graphic drawings.

We used Matlab to evaluate and compare the timbre of the sensitive materials that are required to be tested for their static and strength in the metallography lab. We wrote code to obtain the elastic module of the audio file obtained in Matlab. And by running the code some graphics. Graphs were obtained by using fast fourier transform algorithm. These graphs are: amplitude- frequency (Hz) and decibel- frequency (Hz). When these prototypes are created for prototypes, they can be used in the desired processes.



```
bn.m  just_emodulus.m  findpeaks.m  +
2 - clear all;
3 - close all;
4 - format long
5 - [x,fs]=audioread('EGotol.mp3');
6 - t=(0:length(x)-1)/fs;
7 - plot(t,x);
8 - xlabel('time');
9 - ylabel('amplitude');
10 - figure;
11
12 - c=abs(fft(x)/length(x)); %frekans bilegeni
13 - y_fft=t.*fs/length(x); %Hz'e cevirme
14 - plot(y_fft,c);
15 - xlabel('frekans');
16 - ylabel('amplitude');
17
18 - a=size(y_fft,1);
19 - b=size(y_fft,2);
20 - MaxAmplitude=max(y_fft);
21 - for i = 1:b
22
23 -     if (MaxAmplitude == y_fft(i));
24 -         RowNumber=i;
25 -     end
26 - end
```

Figure 1. Matlab first trial



```
Editor - C:\Users\hpl\Documents\MATLAB\just_emodulus.m
bn.m  just_emodulus.m  findpeaks.m  +
1 % file = 'EGMOD.wav';
2 close all
3 clear all
4 format long
5 [y,Fs] = audioread('EGotol.mp3');
6
7 Nsamps = length(y);
8 t = (1/Fs)*(1:Nsamps); %Prepare time data for plot
9 %Fourier Transform
10 y_fft = abs(fft(y)); %Retain Magnitude
11 y_fft = y_fft(1:Nsamps/2); %Discard Half of Points
12 f = Fs*(0:Nsamps/2-1)/Nsamps; %Prepare freq data for plot
13
14 %Plot Sound File in Time Domain
15 figure
16 plot(t, y);
17 xlabel('Time (s)')
18 ylabel('Amplitude')
19 title('fft action')
20
21 %Plot Sound File in Frequency Domain
22 figure
23 plot(f, y_fft);
24 xlim([0 1000])
25
```

Figure 2. Code for obtaining Matlab graphics

```

Editor - C:\Users\hp\Documents\MATLAB\just_emodulus.m
bn.m just_emodulus.m findpeaks.m
22 %Plot Sound File in Frequency Domain
23 figure
24 plot(f, y_fft);
25 %xlim([0 1000])
26 xlabel('Frequency (Hz)')
27 ylabel('Amplitude')
28 title('Frequency Response of Tuning Fork A4')
29
30 dB = mag2db(abs(y_fft));
31 figure
32 plot(f, dB);
33 xlabel('Frequency')
34 ylabel('Desibel')
35
36
37 %find Frequency of maximum Amplitude
38 a=size(f,1);
39 b=size(y_fft,2);
40 MaxAmplitude=max(y_fft);
41 for i = 1:b
42     if (MaxAmplitude == y_fft(i))
43         RowNumber=i;
44     end
45
46

```

Figure 3. Code for obtaining Matlab graphics

```

Editor - C:\Users\hp\Documents\MATLAB\just_emodulus.m
bn.m just_emodulus.m findpeaks.m
40 b=size(y_fft,2);
41 MaxAmplitude=max(y_fft);
42 for i = 1:b
43     if (MaxAmplitude == y_fft(i))
44         RowNumber=i;
45     end
46 end
47 f(RowNumber);
48
49 %Find peaks points greater than 51
50 j=1;
51 for i=1:b
52     if (y_fft(1,i) >= 51)
53         f_2(1,j)=f(1,i);
54         y_fft_2(1,j)=y_fft(1,i);
55         j=j+1;
56     end
57 [pks,locs] = findpeaks(y_fft_2(1,j),'MinPeakDistance',50);
58 end
59 [pks,locs] = findpeaks(y_fft_2,'MinPeakDistance',25);
60 figure
61 plot(f,y_fft,y_fft(locs),pks,'or')
62 % Find peaks points greater than 51
63
64

```

Figure 4. Code for obtaining Matlab graphics

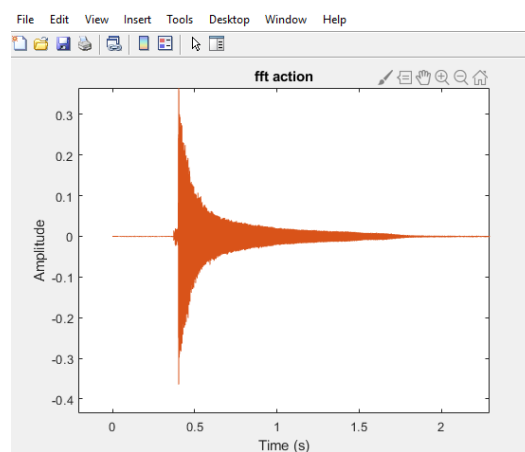
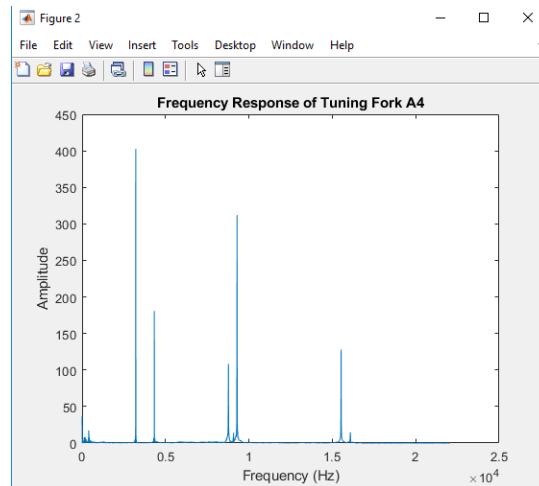
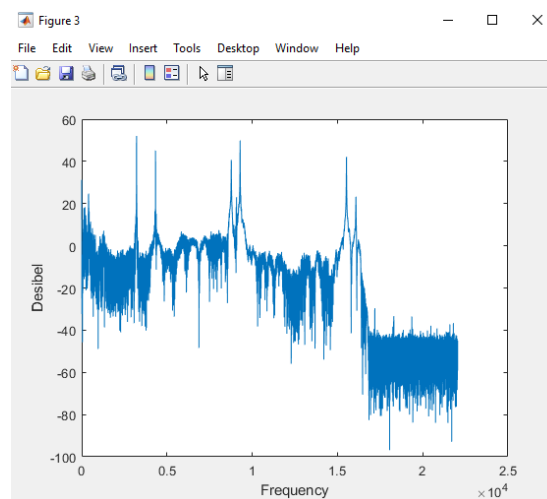


Figure 5. Graph of amplitude- time(s)



*Figure 6. Graph of amplitude- frequency(Hz)*



*Figure 7. Graph of desibel- frequency(hz)*

The program used to perform this process at the center was Matlab. So I did some research on using Matlab. I have looked at how mathematical expressions are written and the loop expressions we use in C. Since my other intern knew how to use Matlab, she tried to tell me what she knew when we wrote the code.

## **2.2.2 Software**

### **2.2.2.1 Nx**

Nx is a computer-aided design program developed and purchased by Siemens. It is an efficient business partner that meets the needs of its designer. Simulation allows the evaluation of models.

In the second semester of the faculty, I learned how to use Nx applications in MFGE108 coded Computer Aided Solid Modeling course. That's why I had no difficulty in using it. My

point was that the dimensions of the parts did not fit during assembly. I was trying again, making the necessary arrangements.

Nx had the possibility to use alternative software. Like SolidWorks and Catia.

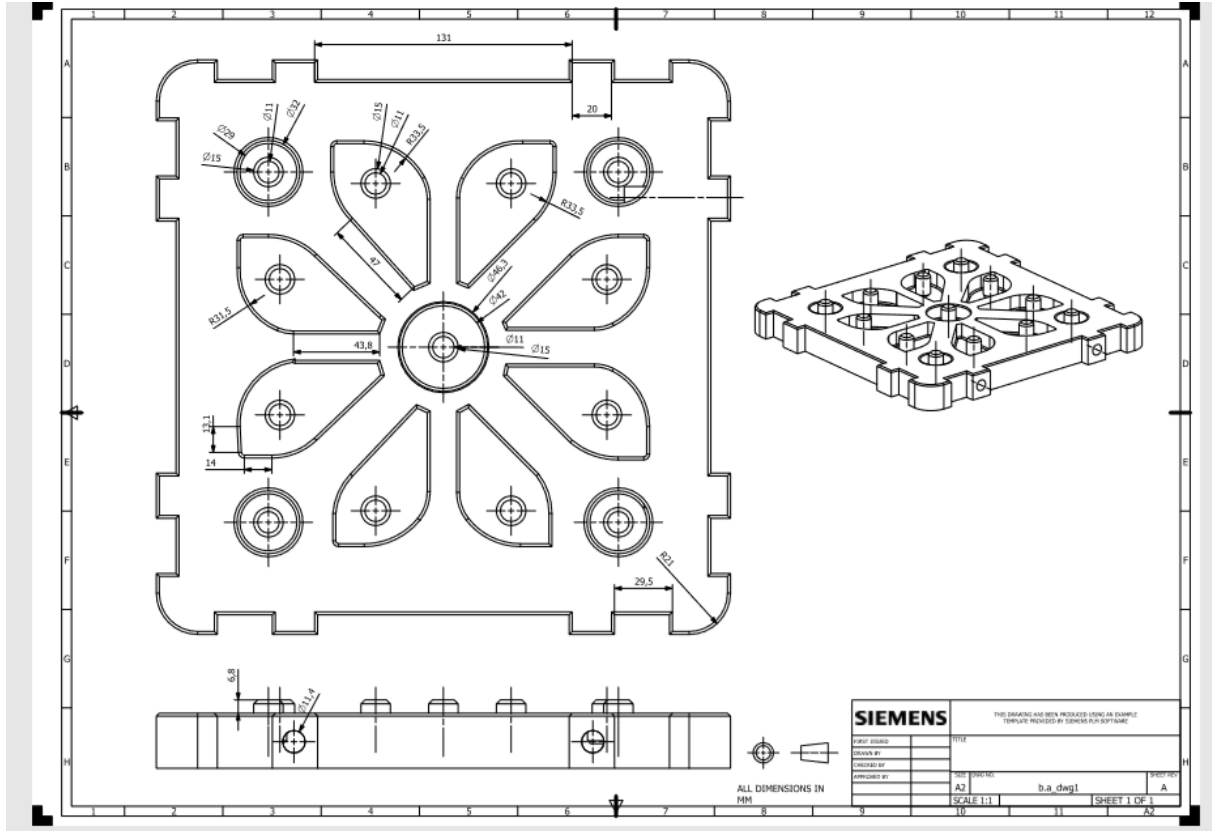


Figure 8. The Nx drawing I made. The production of this piece was made in the center before.

#### 2.2.2.2 NI Data collection system: Labview Signal Express

Data is collected from the production site with NI Data Collection System. It is the recording of situations and processes such as downtime, working time and production quantity of the machine. These records are the source for the production control and analysis of the device. The data acquisition system is integrated with Labview Signal Express software. As noted in the National Instruments' *Getting Strated With Labview* (2012) manual,

“LabVIEW programs are called virtual instruments, or VIs, because their appearance and operation imitate physical instruments, such as oscilloscopes and multimeters. LabVIEW contains a comprehensive set of tools for acquiring, analyzing, displaying, and storing data, as well as tools to help you troubleshoot code you write. In LabVIEW, you build a user interface, or front panel, with controls and indicators. Controls are knobs, push buttons, dials,

and other input mechanisms. Indicators are graphs, LEDs, and other output displays. After you build the front panel, you add code using VIs and structures to control the front panel objects. The block diagram contains this code. You can use LabVIEW to communicate with hardware such as data acquisition, vision, and motion control devices, as well as GPIB, PXI, VXI, RS232, and RS485 instruments” (p.1-1).

As I explained later in my report, I actively used the software to solve the problem. I had been able to use the software by reading the manual for a whole day.

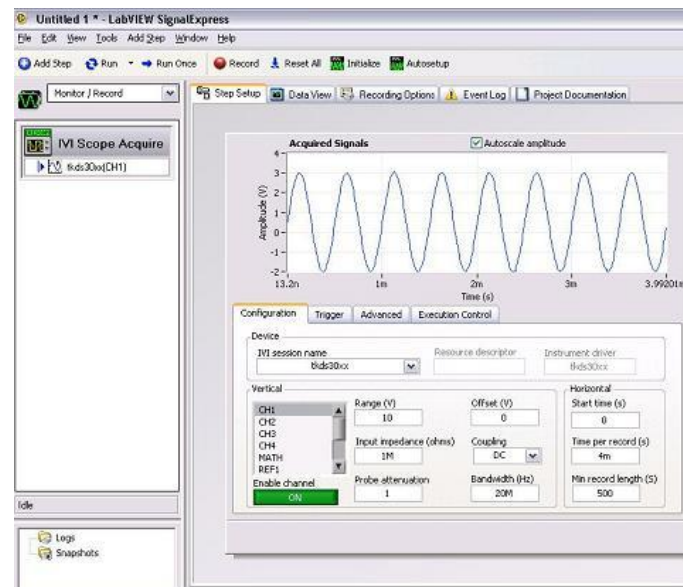


Figure 9. Labview Signal Express

Note. From Add an IVI Instrument Step in NI SignalExpress, July 2019, [www.ni.com](http://www.ni.com)

### 2.2.3 Hardware

As I will talk about later in my report, I have used external equipment in particular. In other words, I have used the keyboard to use the control panels and software and engineering techniques that we create commands of cnc milling machine, cnc lathe machine. I didn't have any difficulty.



*Figure 10. Kitigawa cnc lathe display*

## **2.2.4 Technical**

### **2.2.4.1 GOM Atos**

#### **GOM Tritop Features**

- o Measurement size: 0.1 x 0.1 m
- o Measuring area: 10 x 10 m<sup>2</sup>
- o Measurement temperature: -40 ° C ~ 120 °

#### **Capabilities**

- o Obtaining 3D surface data
- o Reverse engineering
- o Optical dimensional measurement
- o Comparison of CAD and 3D surface data

#### **Specifications**

- o Measuring range (125): 120 x 96 x 80 mm
- o Measuring range (250): 240 x 200 x 200 mm
- o Measuring range (500): 500 x 400 x 400 mm
- o Number of points measured per scan: approx. 2,000,000

Gom Atos is a technique used in place of design programs for solid modeling. Objects are scanned with optical measurement. What we do is the first stage of production of the existing product for the benefit of the center within the framework of the possibilities.

Let's think about the valuable devices in the center and their costly parts. In case of the need of these parts, central cost purchases, existing programs (NX, Catia), the desired part

may occur during the construction of the drawing of the desired part of the work done as a result of errors and so on. away from the development of negative situations. Thanks to Atos, they can scan the parts and obtain their dimensions and make production easier in the center.

The following steps were taken when using GOM Atos:

- o First of all, lenses were fitted for the purpose of the procedure. Wearing lenses is a delicate process that requires attention. Dust should not enter the projector and do not damage the lenses.

- o Then the platform on which the object was seated and the object to be scanned were marked. - Marking, marking for detection of the object while scanning.

- With marking, the device can make dimensioning by placing the object into the space it creates in the direction of the axes which it can accept as reference.

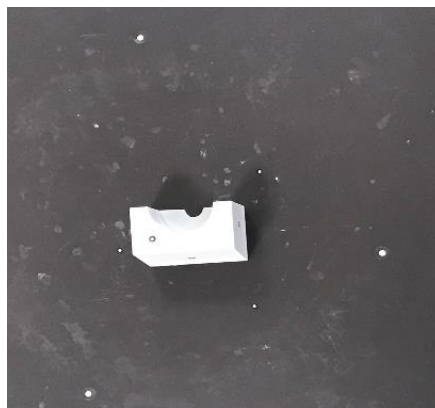
- o Calibration was performed to check the camera's angles.

- o Chalk powder was sprayed on the object to make the scanning process more accurate. Chalk dust also helps to remove the roughness.

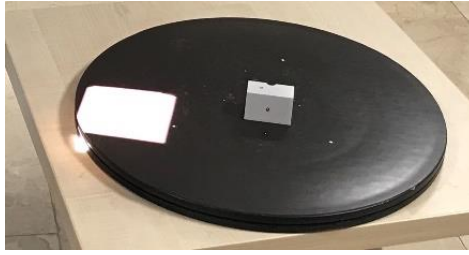
- o The object on the platform is matched with the camera's focus.

- o The sections were then scanned by turning the platform.

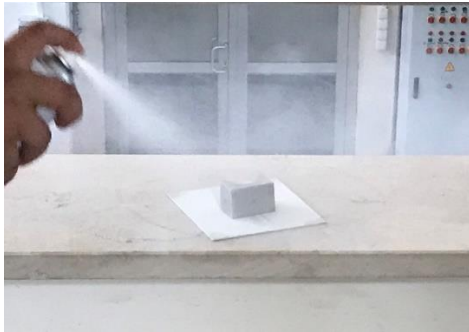
- o After one full round, the scan continued for the problematic locations. Processing was terminated when the desired scan was obtained



*Figure 11. Marking process*



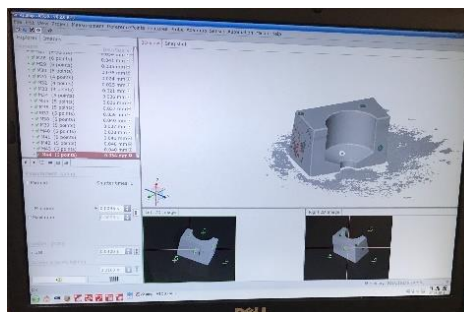
*Figure 12. Focusing*



*Figure 13. Chalk Powder Process*



*Figure 14. Scanning process*



*Figure 15. Images of the scanning process*



### III. ANALYSIS OF PRODUCTION

First of all, I will talk about Vtec cnc milling machine on the front fender mold of the vehicle which is planned to be produced in order to emphasize the engineering faculty on the promotion days of Atılım University.

I will discuss the necessary information about the devices and materials used beforehand so that I cannot interrupt my narration. Vertical machining is done on Vtec cnc milling machine. It also has 4 axes. These axes are x, y, z and angle. Divisor is expressed at an angle. In short, the divisor NC rotary tables enable the diversification of 3-axis vertical machining centers into 4-axis or 5-axis. The material to be machined on the cnc mill is fixed, tool moving. The power of Vtec cnc milling machine is 55kVA and table axis movements are 2400-1300-1000mm. Glass fibers are independent fibers in which different materials can be added according to the intended use obtained by drawing the molten glass. The composite consists of two materials, namely the matrix, the binder, the carrier, that is, the base material. It is a compound which is brought together by processes such as melting and boiling. The compounds formed cannot be easily distinguished.

The process begins with objective documentation of the idea. That is, by shaping the causalities of the idea of the engineer, advancing it under the titles of quality, form, cost and material and making it clear with its design. In order for the mold manufacturing to be processed on the bench, the project authorities send their drawings to the center. The most suitable time for the work planning and demand of the device is determined. According to the width, length and depth ratios of the model, MDF molds are adhered with industrial type glue. The glue takes about 5 hours to dry. After the MDF mold is dry, machining process will start on the cnc milling machine. The technician who is the operator of the cnc mill enters the code according to the dimensions in the drawing. In this code, the tool and the axis on which the operation will be performed are specified numerically. Mdf die processing is commanded. The mold is removed at the end of the machine warning. If roughness is observed in the processed mold, it is smoothed by hand sanding. Coated with glass fiber. Filled with composite. It is sent to the heating process.

I will talk about our simple experiment to learn how to use the Kitigawa cnc lathe to explain the code software. Firstly, Kitigawa cnc lathe operates on two axes. These axes are x and z. The tool is fixed to the muscle of the cnc fereze, the material to be processed is movable. The minimum machining diameter is 320 mm and the turning length is 530 mm. Its power is 20 kVA. As for our experiment, we locked the iron part into the chamber. We

decided to dimension the process from what we did to learn the process. and we've written the appropriate code. And we watched the teams perform the process.



Figure 16. Cnc lathe tool and machined parts



Figure 17. Pedal of cnc lathe



Figure 18. The code we wrote

Table 1

*Description of the abbreviations in our sample code:*

Abbreviations	Descriptions
M3	Anti-clockwise rotation
M4	Clockwise rotation
G97	Motion at constant speed.
G96	As the part approaches the center, the speed increases according to the criteria we have determined.
Alter	Compares the error made when writing the program.
Eob	Closes the line.
Insert	Assigns the program to the program.
M30	Program finished back to top.
M8	Turns on the water.
M9	Closes water.
If the x and z axes are written on the same line in the code, movement on two axes is observed simultaneously; otherwise it gets up and pulls.	

The personnel in the manufacturing hall should have boots on their feet and a hard hat on their head. Wear gloves when in contact with equipment. The Center has fulfilled these requirements for the safety of its employees for each of its staff. And it serves as a warning with warnings placed in frames. Ensuring and applying these standards keeps both employees and central negativities in terms of occupational safety. The importance of the Center for occupational safety supports the aim of the academic experiment. In the 400-liter tank used in cnc mills in the experiment, they use a mixture of ester oil and air instead of 380 liters of water, 20 liters of boron oil. Because, if quality oil is not preferred in the use of boron oil, bacteria that are harmful to human health are produced, and as the cnc mill is filled to the surface of the machine in order to ensure the right and left movement of the machine, there is a possibility of contact with this bacteria socket. It has been observed that ester oil air association is more beneficial in terms of occupational health than boron oil water association. This diligence increases the reliability of the working environment.



*Figure 19. Experiment on CNC milling*

Research and development departments are the areas where the mechatronics engineer can take place more efficiently than the other engineers in the company. Because mechatronics engineers can intersect many disciplines with their training. And as a result, he is able to act faster in terms of idea generation, development, decision-making and implementation.

The future plans of the company are to be the most respected center of industry and academy in the world by achieving the objectives of mission and vision. This progress can be made with qualified personnel, business partners and projects.

## IV. INTERNSHIP PROJECT

In my internship, I will talk about my two most effective and competent projects. The first includes Mawi Crank press software and data recording, the second includes the design of the apparatus for fatigue testing.

### 4.1. Mawi Crank press

Mawi Crank press is one of the machines used by Metal Forming Center of Excellence in metal forming manufacturing.



*Figure 20. Mawi Crank press*

*Note. Mawi Crank press from <https://www.atilim.edu.tr/tr/msmm/page/3077/mawi-krank-pres>*



*Figure 21. Mawi Mawi Crank press internal mechanism*

*Note. Mawi Crank press internal mechanism from <https://www.atilim.edu.tr/tr/msmm/page/3077/mawi-krank-pres>*

Mawi Crank press features:

- o Mass forming process (shaping of metals with initial forms of mass), extrusion forging (compression of the metal part to be processed by means of mold)

- o Maximum capacity: 300 Kn

- o Landing speed: 23-30 spm

Another feature that makes this press important for the center is the fact that the manufactured parts take orders from abroad and add value to the center financially.

The reason for working with the press is not a mechanical problem. The software, which has been associated with the press for some time (about a year), has been unable to perform the desired function.

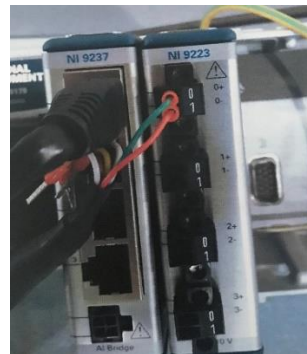
The steps taken to solve the problem proceeded as follows: first the manual, which was prepared by Sinan Akbulut to help the former employees of the center, was first examined. The connection box of the electronic displacement sensor, electronic gauge and the strain gauge attached to the right connecting rod and the analog input module (NI 9223-NI 9237) were performed. As a result of the checks, it was observed that the strain gauge integrated in the right connecting rod was lubricated due to the absence of a protective sleeve. On top of that, the integrated (NI 9945) and cables were cleaned by means of alcohol and connection controls were made.



*Figure 22. Hardware displacement of laser displacement sensor*



*Figure 23. Strain gauge*



*Figure 24. Analog input module*

Then, Labview Signal Express "software, which is shown as the main problem and cannot function properly, was audited. The inspection proceeded for almost eight days. During this period, the second part of the manual, Labview Signal Express program, under the title of creating a file for the sample attempts were made to understand the problem. These experiments included establishing the conditions and conditions required for the sample.

Tests mean:

- o First of all, it is necessary to determine the .seproj files containing the requirements of the desired process in the first installation by separating them from other experiments and to create a .seproj file in the software,
- o Then create the manual conditions for signal selection, log summary, start conditions and stop conditions in the Options Recording Options "tab,
- o The most important problem encountered during this process is the inability to select the channel selection in the software where the analog input and strain gauge modules are located in the measurement kit and 3mod2\_ai0 instead of 2mod2\_ai0 in signal selection for strain and voltage.

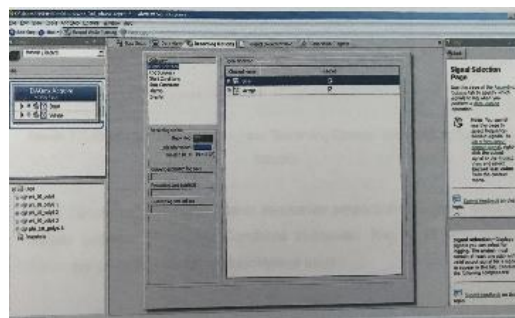


Figure 25. Recording Options tab

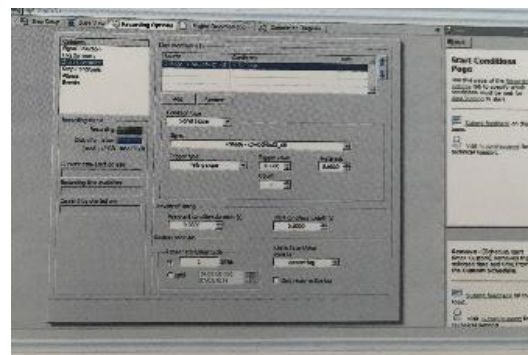


Figure 26. Start Condition tab

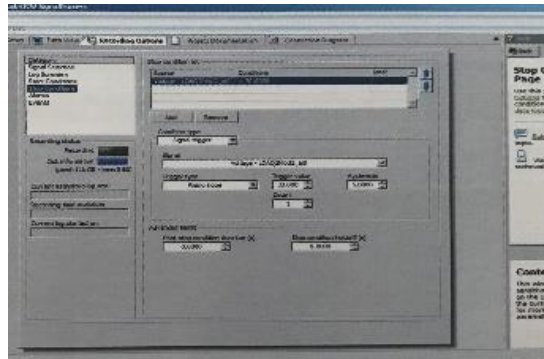


Figure 27. Stop Condition tap

o Calibration of the measurement system, strain gauge, was made after the conditions of the sample to be tested as a result of solving the problem,

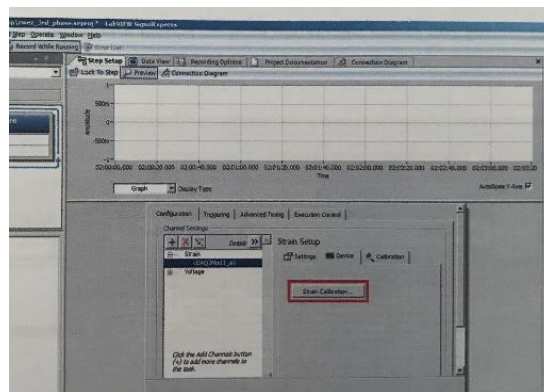


Figure 28. Strain Calibration tap

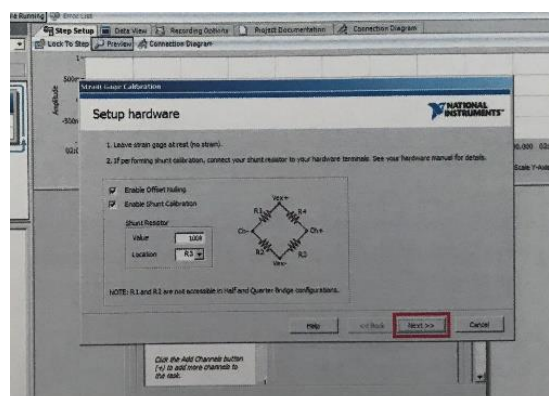


Figure 29. Device Calibration tap

o In the setup step setup "tab, there were some problems that prolonged the success of the device - strain calibration - calibrate process. These were similar to the previously encountered channel problem, the success of the calibrate process, and the condition file created for the sample, although no process was carried out by assigning an error value.



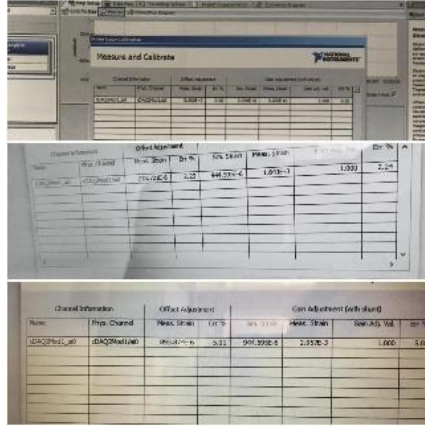


Figure 30. Error during calibrate

o It resulted in determining and testing the operation priority of the pedal-controlled press during the run of the file created by overcoming problems. Because the "Labview Signal Express" prepared for the center and examined for problems, no reason could be found in the Turkish and English manuals.

As a result of this, at the end of the direction, a few of the engineers who had knowledge about the device were directed to the strain gauge section attached to the right connecting rod. And the resistance of the strain gauge mechanism due to the expansion of the cables, where the lubrication problem persists due to the lack of protective sheath

It was found that the desired operations could not be performed in line with the variability of the values. It has been realized that the resistance value to be obtained by multimeter measurement is not 350 ohms and short circuit formation can be observed. A solution suggestion is that the compartment is cleaned with alcohol and degreased, then the integrated (NI 9945) and cables are renewed and the strain gauge is coated to prevent external factors. According to the common opinion, performing these applications will solve the problem.

And Sinan Akbulut, who we applied by e-mail for the solution of our problems, mentioned that there may be some other calibration that he could not make sense except the calibrations made in the .seproj file.

Cost calculation for the realization of this solution:

(The price is so high that the company's purchase agreement is due.)

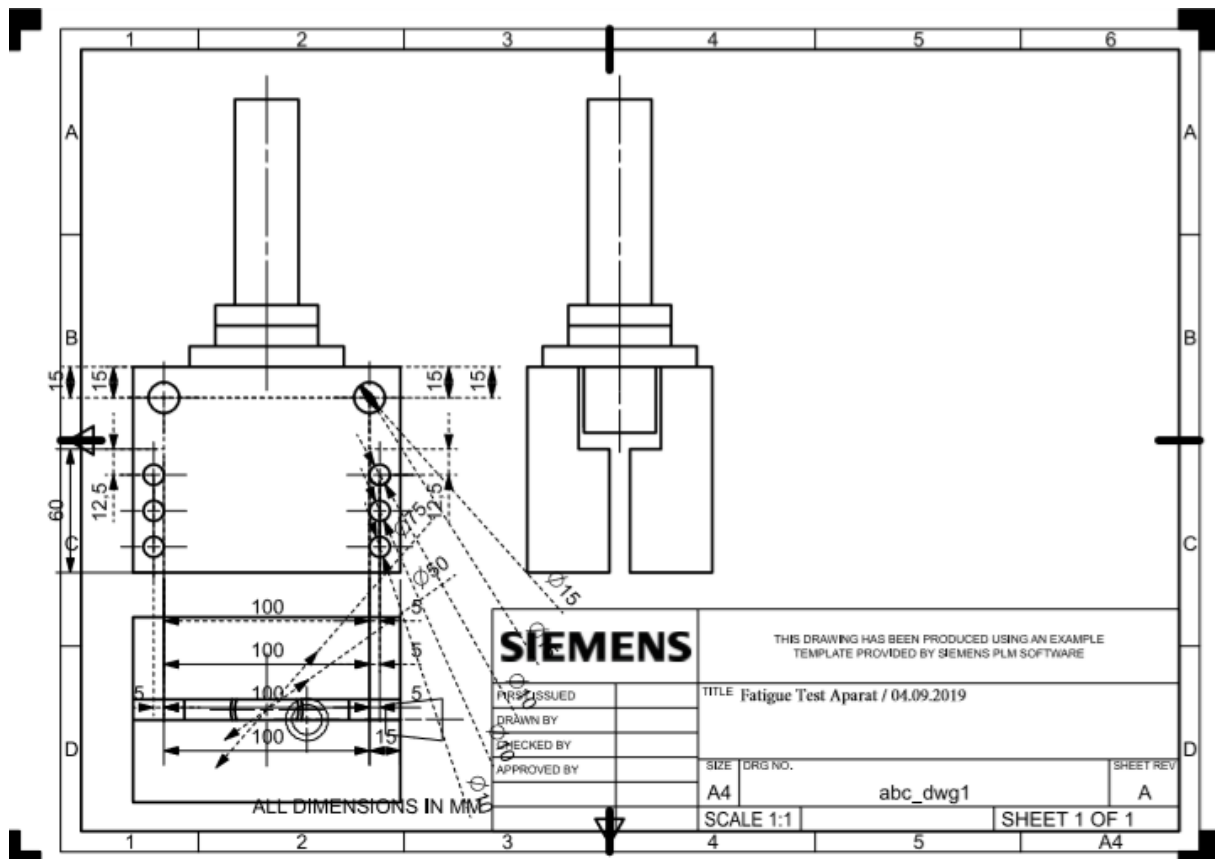
- o NI 9945 Integration: \$ 500
- o Renovation of Cables: \$ 35
- o Supplying Protective Case: \$ 15

## **4.2 The apparatus for fatigue testing**

Fatigue testing is carried out on the elements of the structures formed in many different fields of production. Let's think of the excavator as a construction machine. Excavator elements: bucket, adapter, adapter tip (nail), pins, circles, side blades, bushings, tiles, walking (chain), pods and so on. Let us consider the operations that the excavator elements repeat under variable conditions after many years of use. Although the parts under the stress of the repeated processes are smaller than the static resistance, some cracking occurs. as the number of repetitions of the process increases, the cracks become visible. And a certain number of these fractures cause the material to break. This is called fatigue. It is not possible to predict fatigue stress in advance. However, the surface roughness, scratches, where the change occurs, tells us where the stress can occur. The fatigue test also allows to obtain useful data for quality control and material improvement of parts that will be subjected to repetitive loads, such as in the excavator.

I was commissioned to design an apparatus at the center that could withstand approximately 200 kN of operations. The length of the parts to be tested would be about 150 mm.

But there should be many standards in the design of the apparatus. The machines used for tensile testing, tensile strength and yield strength, as specified in the American Union State Road and Transportation Officers Standard and described in "Standard Test Methods for Tensile Testing of Metallic Materials 1" (2013) range. Various holding devices can be used to transmit the force measured by the testing machine. To ensure the axial tensile stress at the measurement length, the axis of the test specimen must correspond to the center line of the heads of the test machine (p.2). Since there are many dimensioning criteria such as those mentioned, I have chosen a model of Universal Grip Company that I can work on. And after assembling the parts of the apparatus with the help of Nx, I delivered the final version.



Note: I did not have the opportunity to visually edit the final version of the drawing due to the license error of the Nx software at the center.

## V. CONCLUSION

At the Metal Forming Center of Excellence, I conducted my summer internship between August 6 and September 6, which includes mechatronics technologies coded Mece 399, all steps of production technologies and limited mechatronics design issues.

I have gained a lot of experience with the activities I participated in. With the code I wrote on cnc milling and cnc lathes, I enabled the machine to perform the correct function. I designed the product for a purpose with solid modeling programs. I did the inspections of the Mawi Crank press and focused on the software to solve the problem. I learned the working principle of the software and audited the calibration of the software. I found that the source of the problem was strain gauge based on the data of my experiments. And I reported the solution with the cost.

In order to minimize the drawing errors that may occur in the use of programs such as Nx and Catia, I made use of the scanning technique with GOM Atos for the given object in the pre-production stage. By learning Matlab programming language, I obtained a graphical analysis of the test data for static and strength of objects. I was able to observe in detail the mold heating process of the machining on the cnc mill. I learned the purpose of fatigue testing and designed the needed apparatus. By learning the purpose of fatigue testing, I designed the necessary apparatus. I understood the requirements of the academic research by establishing the conditions and obtaining the supporting data.

I have experienced the social needs of working ethics with my devoted employees in a good center with my daily observations and desk work. While I realized the communicative requirements that information transfer, exchange of ideas and business planning necessitated in human beings, I gained professional experience that I could not get so effectively in school by integrating with myself.

During the four semesters of the school, I learned the theoretical application of my courses. I began to explore ways to make myself more efficient by identifying how I could improve and what I lacked through my skills and making effective decisions.

In my opinion, this is an application that prepares the students of the departments for business life and conditions and must be applied. This process enables the formation of the qualifications that must be acquired and acquired. It allows the person to better integrate himself / herself with his / her profession and to question the correctness of his / her choice. I

think that the questioning is a good evaluation process in order to be productive for the candidate engineer who will take part in the future of business life.

## REFERENCES

- Akbulut, S. (2014). *Zwez Chemie Lubricants Performance Tests Project Working Report*
- “Getting Started with LabVIEW Virtual Instruments.” (2012). *Chapter 1: Getting Started with LabVIEW Virtual Instruments.*
- “Standard Test Methods for Tension Testing of Metallic Materials1” (2013). *Part 5: Apparatus.*

## APPENDICES

Figure 9. Labview Signal Express

Note. From Add an IVI Instrument Step in NI SignalExpress, July 2019, [www.ni.com](http://www.ni.com)

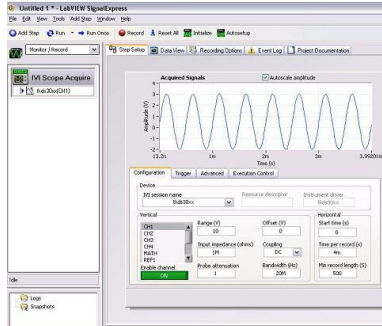


Figure 20. Mawi Crank press

Note. Mawi Crank press from <https://www.atilim.edu.tr/tr/msmm/page/3077/mawi-krank-pres>



Figure 21. Mawi Mawi Crank press internal mechanism

Note. Mawi Crank press internal mechanism from <https://www.atilim.edu.tr/tr/msmm/page/3077/mawi-krank-pres>

