

GISPAM 2016



GISPAM2016 - Students

GISPAM 2016

GNU
International Summer Program of AFDEX
and other Engineering Softwares
for the State of Mexico



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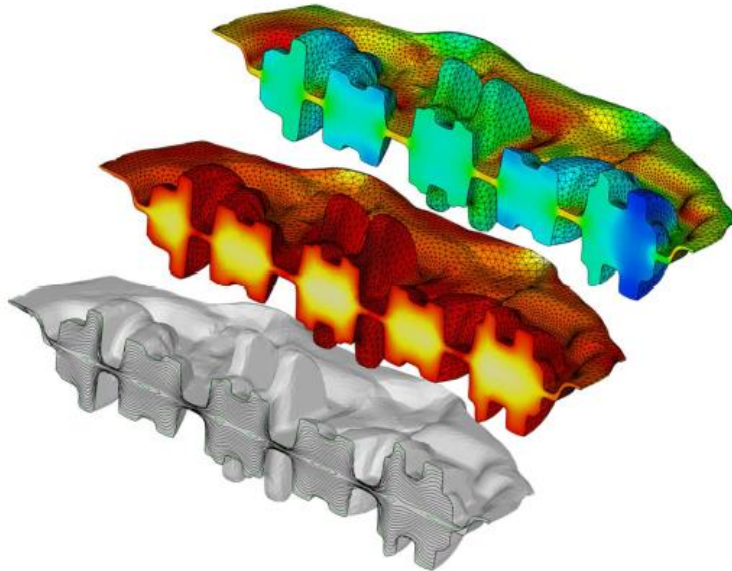
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July 18 ~ August 20, 2016
Gyeongsang National University

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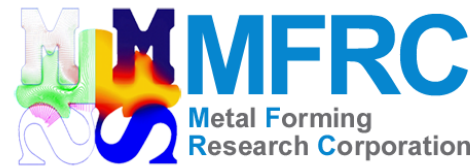
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GISPAM 2016 - Schedule

	Contents of Education
1 st Week	• Orientation • Basic Theory • 2D CAD
2 nd Week	• 3D CAD (CATIA) • CAE practice
3 rd Week	• FEM • AFDEX 3D • MAPS 3D
4 th Week	• RecurDyn • Team Project • Evaluation
5 th Week	• Culture/history tour • Industry tour • MFCAE 2016



AUTODESK
AUTOCAD



(주) 브이엠테크



FunctionBay, Inc.



RECURDYN



The 1st week

The 1st week

Schedule

Week1			Morning(~ 12 : 00)	Afternoon(~ 18:00)	Evening (18:00 ~)	
July	18	Mon	Orientation	Manufacturing Engineering and industry	Welcome party	Dormitory
	19	Tue	About Korea		Homework	Dormitory
	20	Wed	Basic mathematics, Statics		Homework	Dormitory
	21	Thu	Introduction to Solid Mechanics, 2D CAD for CAE		Homework	Dormitory
	22	Fri	AFDEX 2D, CAE Practice		Rest	Dormitory
	23	Sat	[Tour-1] Jinju city tour		Rest	Dormitory
	24	Sun	Free time		Rest	Dormitory

Opening Ceremony/Orientation / Manufacturing Eng.



Welcome Dinner Party!



Mathematical Backgrounds and Basic Mechanics



Jinju Tour



Jinju Tour





The 2nd week

The 2nd week

Schedule

Week2			Morning(~ 12 : 00)	Afternoon(~ 18:00)	Evening (18:00 ~)	
July	25	Mon	Fundamental of heat transfer	Solid mechanics	Homework	Dormitory
	26	Tue	3D CAD Basic I	3D CAD Basic II	Homework	Dormitory
	27	Wed	3D CAD Advanced I	3D CAD Advanced II	Homework	Dormitory
	28	Thu	3D CAD Practice I	3D CAD Practice II	Rest	Dormitory
	29	Fri	[Field trip-1] GTIC, KITECH	[Field trip-2, Tour-2] POSCO	Rest	Dormitory
	30	Sat	[Tour-3] Busan city tour		Rest	Dormitory
	31	Sun	Free time		Rest	Dormitory

CATIA



Soccer & Chicken-Beer Party



KITECH & GNU/TIC & POSCO



Busan





The 3rd week

The 3rd week

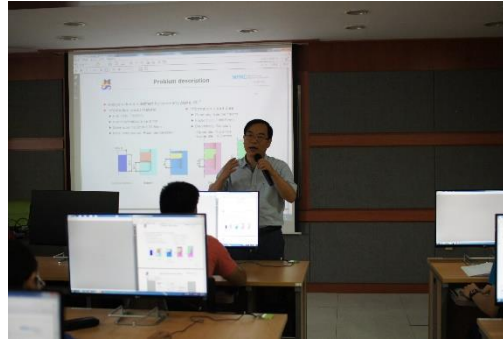
Schedule

Week3			Morning(~ 12 : 00)	Afternoon(~ 18:00)	Evening (18:00 ~)	
Aug	1	Mon	Fundamental of heat transfer	Theory of plasticity	Homework	Dormitory
	2	Tue	FEM	AFDEX 3D	Homework	Dormitory
	3	Wed	AFDEX 3D Practice	MAPS 3D	Homework	Dormitory
	4	Thu	MAPS 3D	MAPS 3D	Homework	Dormitory
	5	Fri	MAPS 3D	MAPS 3D	Rest	Dormitory
	6	Sat	[Tour-4] Namhae, Sangju Beach		Rest	Dormitory
	7	Sun	Free time		Rest	Dormitory

Theory – Advanced Solid Mechanics and FEM



Process Design Using AFDEX



MAPS 3D



Sangju Beach and Pork Barbecue Party



Pork Barbecue Party





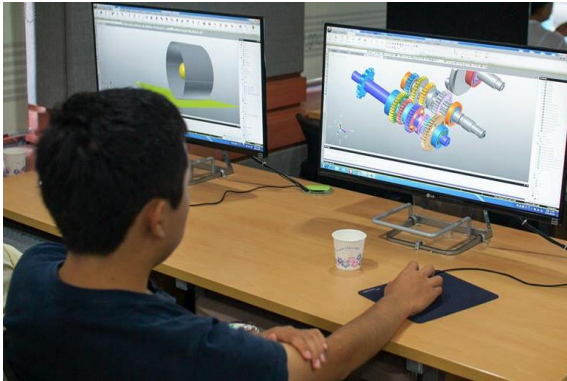
The 4th week

The 4th week

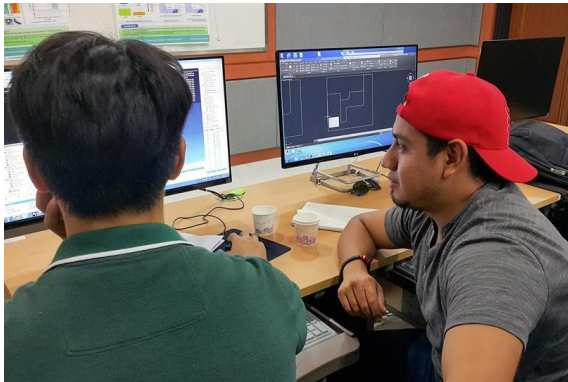
Schedule

Week4			Morning(~ 12 : 00)	Afternoon(~ 18:00)	Evening (18:00 ~)	
Aug	8	Mon	Dynamics	RecurDyn	Homework	Dormitory
	9	Tue	RecurDyn	RecurDyn	Homework	Dormitory
	10	Wed	RecurDyn	RecurDyn	Homework	Dormitory
	11	Thu	PPT skill	Team project I	Homework	Dormitory
	12	Fri	Team project II	Team project evaluation	Farewell Party	Dormitory
	13	Sat	[Tour-5] Seoul culture experience		Rest	Seoul
	14	Sun	[Tour-6] Seoul culture experience		Rest	Seoul

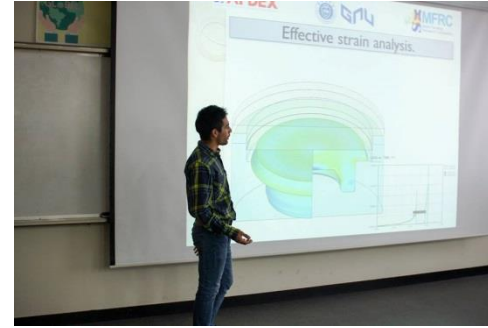
RecurDyn



Preparing Final Presentation and Traditional Dish



Final Presentation



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UPVM
TESO
AFDEX

Power Axle

I.A. Hernandez Chavez*, C.E. Navarro Gallegos*, E.C. Villagras Beltrán*

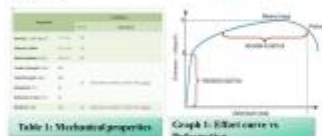
*Mechatronics Engineering, UPVM, State of Mexico
*Electric Mechanical Engineering, UNAM, State of Mexico
*Computer Systems Engineering, TESO, State of Mexico

Abstract

In this paper, axle is a mechanical device which is used to keep rotational movement of any mechanical machine. This workpiece occupies a very important place in the industry, because without this piece none other could not work. Axes are always adjusted in determined points of a machine, they can be either fixed or free; it depends on the application we are using. Development of workpiece we used simulation software: CAD, CATIA and AFDEX are used for the design and metal forming process simulation. Practically all metals which aren't used in cast form are reduced to some standard shapes for subsequent processing. The shapes are further processed through hot rolling, forging or extrusion, to produce materials in standard form such as plates, sheets, rods, tubes and structural sections. Axes has multiple uses very important in the industry for example: Engine, Turbine, Suspension, Overhaul, Tractor and others. It purpose of the piece is allows transfer mechanical systems.

Introduction

Metal forming is a manufacturing process in which force are applied on raw material such that stresses induced in the material are greater than yield stress and less than ultimate stress. The material experiences plastic deformation to change the shape of the component and converted to the desired shape of the component, the velocity of formation and friction are factors that affect the performance of metal forming.



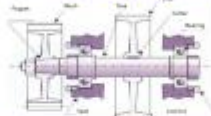
Objectives

1. Know the ways for metal forming to materials required and plastic deformation generating.
2. Designing a model trying to use a less or possible amount of material that it could be created without wasting steel.

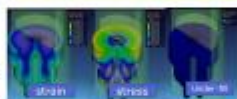
Project development



Axis parts



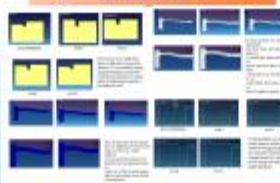
Result and conclusion



Conclusion

Through this course and project we have learnt the basics of metal forming which is fairly useful because in the future we might apply all of the knowledge acquired in our country, being that this branch of mechanics has not been developed in Mexico yet, therefore we feel really grateful for having gotten such a nice and unforgettable experience because we have learnt not only about mechanical engineering and lots of software's but also we can say about here we see the world has completely changed because we had not realized about before. For sure we will never forget this amazing experience and also we will make sure to apply this invaluable approach to AFDEX software.

Homework 1



Discussion

The table shown above displays how some different factors we took into account were changing when varying distance "A", it's highly important to know its behavior so that we can predict in advance whether or not our equation would work out, an accurate example of this conclusion is our simulation because it does not have a definite component, with that said, it may be possible that one simulation can be fairly accurate for certain length values in distance "A", but there might be others which may affect the metal forming process because one factor or more can be totally wrong.

Homework 2



Results



CONCLUSION

- We solved the problem and we tried a lot of time in determining the size of workpiece. After all we need to define the number of local mesh density control for upper die.

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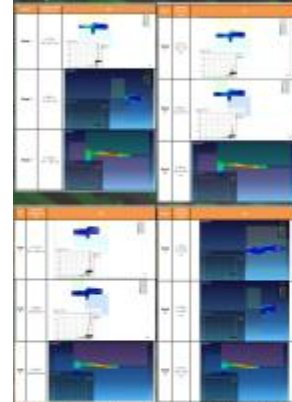
SIMULATION OF FORMING PROCESS FOR A WELDING NECK FLANGE

AFDEX
TESO
UPVM

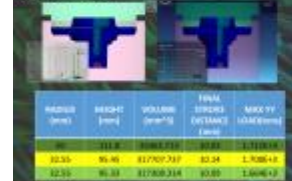
Diego Alejandro Sánchez Martínez, Universidad Politécnica del Estado de México
LUIS ANTONIO SANDOVAL MEDINA, DAVID SANCHEZ CALLEJAS, IRISANA RESENDIZ GONZALEZ

PREVIOUS KNOWLEDGE

Specialized knowledge in metal forming is needed in order to develop a simulation process, thus we did some specific assignments to get it. We learned to export our results and analyze them in this first task.



In the second assignment we developed our ability to set the required conditions for our material



INTRODUCTION

Welding Neck Flanges are easy to recognize at the long tapered hub, that goes gradually over to the wall thickness from a pipe or fitting. The long tapered hub provides an important reinforcement for use in several applications involving high pressure, sub-zero and elevated temperatures.



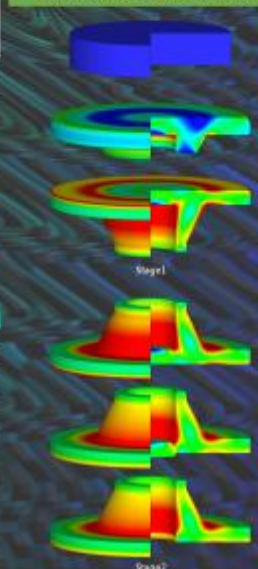
INFORMATION

► AISI1020(T=20 - 1300°C)

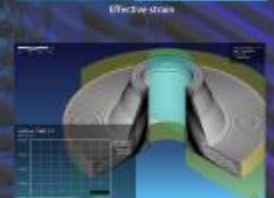
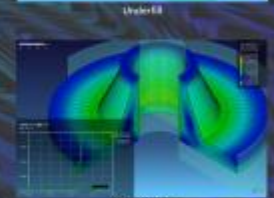
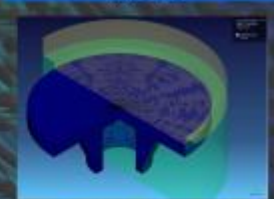
- Solid cylindrical slice of rod R=95.5 mm, h=43.7 mm
- Initial temperature: 1300°C
- Geometry: See the figures
- Friction: Graphite + Water Hot (steel)
- Die velocity: Constant
- Upper die: -200.0 mm/s
- Lower die: 0.0 mm/s



DEFORMATION HISTORY



RESULTS



DISCUSSION

These were the die shapes used for each stage. There is no under fill defect present in any stage of the process. The maximum effective stress value is 3.74.

Flow line analysis shows the deformation behavior of the work piece during forging. The maximum load used in Y-axis is 4.01 x10³ tons.

CONCLUSION

Due to the big size of the piece the maximum load is high as well as the strain, but it is possible to fabricate it with a medium capacity press.

If more stages are added to the process it would be possible to reduce these values

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OPTIMIZATION OF STEM NUT PRODUCTION USING FINITE ELEMENT ANALYSIS

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¹ Universidad Politécnica del Valle de México, ² Tecnológico de Estudios Superiores de Chalco, ³ Universidad Politécnica del Valle de México

Background

AFDEX is a general-purpose metal forming simulator, which meets the following requirements for intelligent bulk-metal-forming simulation. AFDEX is theoretically based on the rigid- or elasto-thermoviscoplastic finite element method. AFDEX 3D employs tetrahedral elements.

Homework 1: Define the initial size of workpiece



From our experience result we can see that every case have different shape of part. Based on our observation we conclude that the best has the smallest volume.

Homework 2: Define the initial size of workpiece



Based on the simulation conducted by trial and error it has been determined that the radius and the optimum height is 20 mm and 112.5 mm respectively to get the desired specification in the piece with respect to the requirements.

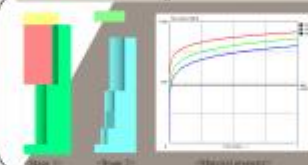
Optimization

Get new knowledge about design programs such as CATIA, AUTOCAD and AFDEX, for improve and help development in our country.

Objective

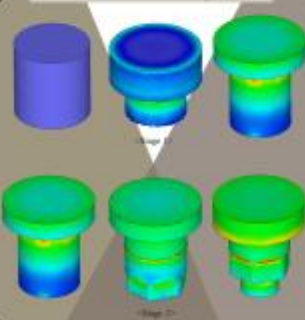


Forming information

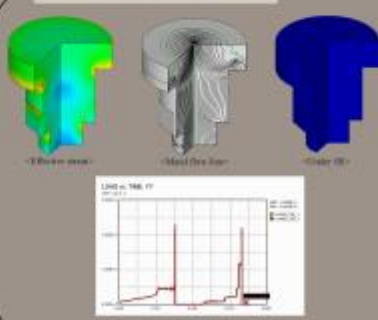


- AISI 4140S (T=20-200°C)
- Solid cylindrical slice of rod
- R=24.8 mm, h=50.0 mm
- Initial temperature: 25°C
- Geometry: See the figures
- Friction: $\mu = 0.1$
- Die velocity: Constant
- Upper die: -1.0 mm/s
- Lower die: 0.0 mm/s

Deformation history



Simulation result



Conclusions

AFDEX simulation improves the design and allows to reduce costs, time, workforce and material. This means that the simulation improves business development.

While this project we learned to design in some programs such as Catia and Autocad and also to make simulation in AFDEX. This means that in the future, this will allow us to improve and develop the design in our country.

GNU International Summer Program of AFDEX and other engineering softwares for the State of Mexico 2016

Simulation and Analysis of a High Impact Socket Using AFDEX

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Key words: AFDEX, Cold Forging Simulation, High Impact Socket Simulation

ABSTRACT

On this work were used two simulations of a high impact socket made on the software AFDEX. The data given at the end of the simulation is used to compare both and determine which has better results. The simulations have almost the same conditions and characteristics on the first stage (forming) but in the second stage (piercing) they are different, while the first simulation makes in the same direction as the forming, the second simulation makes the piercing on the opposite direction.

INTRODUCTION

Forging Process consists on the controlled deformation of a material until the desired final shape is obtained using pressure or multiple impacts. Forging is used because it is easy to make a huge production of pieces which are very accurate.

A high impact socket is a very common and used instrument to make any kind of processes, the function of this sockets is tight or loosen bolts and nuts in combination with a ratcheting tool. However, high impact sockets are used in situations where the torque is, as its name indicates, high.

The material used on the simulation was AISI-1010, its data is showed below.



Fig. 1 High impact socket

Properties	Material	Element	Conc (%)
Tensile strength	355MPa	Iron, Fe	99.22 - 99.97%
Yield strength (depending on length)	355MPa	Manganese Mn	0.3 - 0.6%
Elastic modulus	190-210GPa	Sulfur S	0.025 %
Shear modulus (typical for steel)	140 GPa	Phosphorus P	0.040 %
Shear modulus (typical for steel)	80 GPa	Carbon C	0.08 - 0.13 %
Resonance ratio	0.27-0.30		

Table 1: Data of AISI-1010

PROJECT OBJECTIVES

1. To determine the best shape of the forging dies and size of the work piece.
2. To determine which simulation has better results in order to make a better final piece.

METHODOLOGY



RESULT AND DISCUSSION

Result are very similar between simulation 1 and simulation 2, as we can see on the pictures above. There are notable differences on forming load and underfill. Both simulations have imperfections on the piercing area.

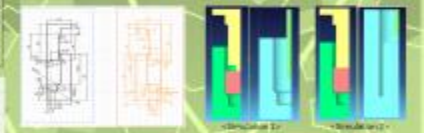


Fig. 2 Dimension of the dies

Fig. 3 Stages of simulation 1 and 2

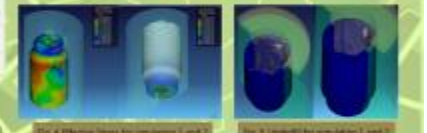


Fig. 4 Effective stress for simulation 1 and 2

Fig. 5 Underfill for simulation 1 and 2

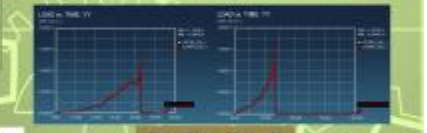


Fig. 6 Load for simulation 1 and 2

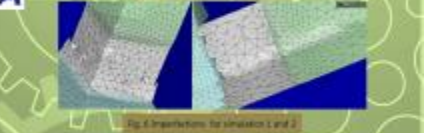


Fig. 7 Imperfections for simulation 1 and 2

CONCLUSION

Both simulations have low underfill, but the underfill in the second simulation is lower than in the first simulation. So the dies used on the second simulation were more effective to make the forming of the metal, however the load in the second simulation was greater than in the first one.

The piercing is not ideal and there are imperfections on the final shape. So we need to modify the dies of the second stages in order to have an appropriate piercing.

As we can see with the matching of these simulations, AFDEX is useful to evaluate the viability of a forging process, if it is possible to make a piece or have an idea of the result of forging process. Also, we can choose, evaluating the results, between two similar simulations which will have better results. AFDEX can save time, money and work in a real application by making simulations like these.

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MicroForming Process of Flange

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Abstract

This paper contains the main applications about the use of software as: AutoCAD, CATIA and AFDEX. So, AutoCAD had been made the mold design, CATIA had been made the design of flange in 3D and finally AFDEX had been to simulation of process, in where, AFDEX has the quality to simulate hot process or cold process, showing the different characteristics that can have the different process.

Micro Forming

Micro forming is a well suited technology to manufacture very small metallic parts, in particular for mass production, as they are required in many industrial products resulting from micro technology.

Review

Before making this project, we perform two tasks to practice our acquired skills in AutoCAD, CATIA and AFDEX, the tasks were made with Asian students. The first activity consisted in make a complete simulation about a piece and the second task consisted in change the measures to find the appropriate workpiece volume.



Figure1. First task



Figure2. Second task

Designs



Figure3. Mold design



Figure4. CATIA Design

Results



Figure5. Load vs time



Figure6. Flow line



Figure7. Concept

Process condition

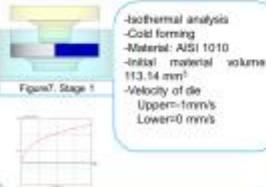


Figure7. Stage 1

-Isothermal analysis
-Cold forming
-Material: AISI 1010
-Initial material volume: 113.54 mm³
-Velocity of die: Upper=1mm/s, Lower=0 mm/s

Simulation



Figure8. Stages

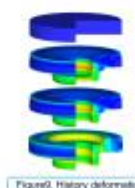


Figure9. History deformation

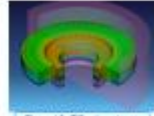


Figure10. Effective stress



Figure11. Under fill

Conclusion

Metal forming process before its production need to be developed with help of CAD and CAE software, permitting save manufacturing-cost and manufacturing-time.

With this simulation we are able to solve many needs in different manufacturing areas like aerospace, automotive, microforming, medical, among.

Applying forging process for designing of wheel hub using AFDEX & CAD Softwares

O. Guzman¹, F. Hipolito Mercado², M. A. Chavez Garcia³, J. L. Guzman Avalos⁴

¹ Universidad Nacional Autónoma de México, ² Universidad Politécnica de Atlix, ³ Universidad Politécnica del Valle de México, ⁴ Universidad Politécnica del Valle de México

Abstract

Currently, the traditional method of wheel hub making is by CNC lathe, which is very expensive, takes a lot of time and waste material (shavings). This paper introduces a solution of the problems commented above by the analysis and design of wheel hub using forging process as an alternative method of production, with the support of different engineering software as AFDEX, Catia and AutoCad. The analysis is composed of three stages, that is workpiece and dies optimal sizes, stroke and material quantity, simulations and final results.

Research Background



Fig 1. Lathe turning material



Fig 2. CNC lathe



Fig 3. Material wasting (shavings)

Flow chart of solving



About Homework 2



Fig 4. Dies and piecework design



Fig 5. First design shows empty spaces



Fig 6. Piecework size modification



Fig 7. 2D simulation and Load vs VY graph analysis



Fig 8. Modification of mesh density parameters



Fig 9. 2D Workpiece and dies density parameters

Physical properties of AISI 52100

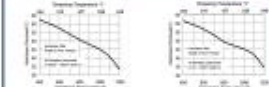


Fig 4. Graphs that show properties of material

Forging load calculation

$$U_{total} = U_{ideal} + U_{friction} + U_{redundant}$$

$$\eta = \frac{U_{ideal}}{U_{total}}$$

Equation of total energy required for deformation process and efficiency of a given deformation process

Workpiece and dies design



Fig 5. Size of workpiece and dies



Fig 12. Catia 3D workpiece



Fig 13. AutoCad draws using 2D analysis saves time

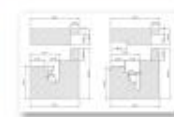


Fig 14. AutoCad draws using 2D analysis saves time

Load vs XX and YY



Fig 17. From left to right, Graphs show decreased of load application



Fig 15. From left to right, Comparison between flow lines, Right picture is final result

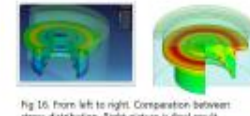


Fig 16. From left to right, Comparison between stress distribution, Right picture is final result

Conclusions

- Final results of stress and strain are low. This can be interpreted as money saving because we do not need a large machine to applied a small force.
- Flow lines are uniformly separated, this means piecework is less propensive to present failure zones (cracks).
- Initial full fill problem was solved by modifying the deepest part of the workpiece and increasing the radius of chamfer.
- Pressure decrease a lot after many modifications of workpiece and dies because: corners get a softer shape.
- Better distribution of material among workpiece.



The 5th week

The 5th week

Schedule

Week5			Morning(~ 12 : 00)	Afternoon(~ 18:00)	Evening (18:00 ~)	
Aug	15	Mon	[Tour-7] Seoul culture experience		Rest	Gyeongju
	16	Tue	[Field trip-3, Tour-8] Gyeongju city tour (Sungjin FO-MA)		Rest	Gyeongju
	17	Wed	[Field trip-4, Tour-9] Gyeongju city tour (Hyundai Car Factory)		Rest	Busan
	18	Thu	MFCAE 2016		Rest	Jeju
	19	Fri	[Tour-10] Jeju tour		Farewell party	Seoul
	20	Sat	Departure to Mexico			

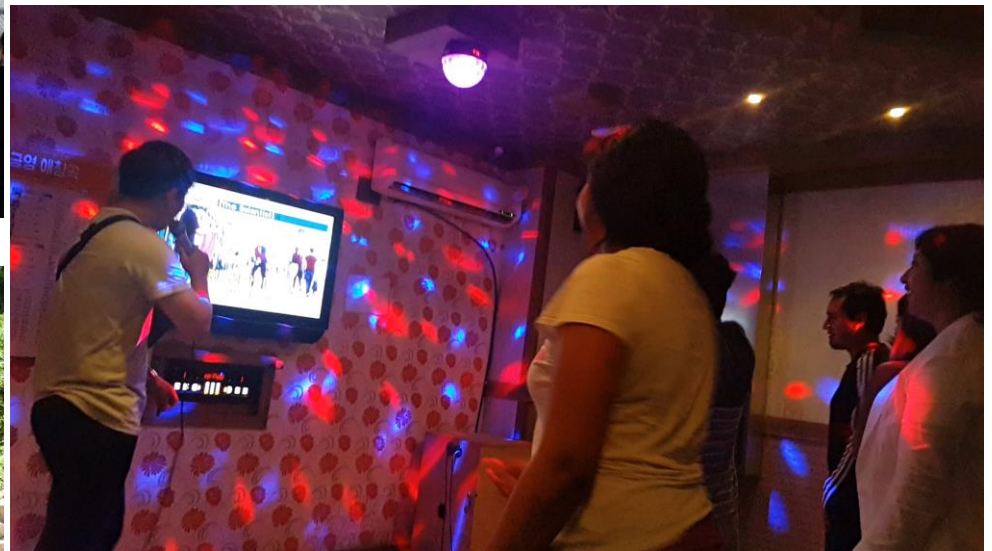
Seoul Tour - Learning Dance & TaeKwonDo



Seoul Tour



Gyeongju Tour

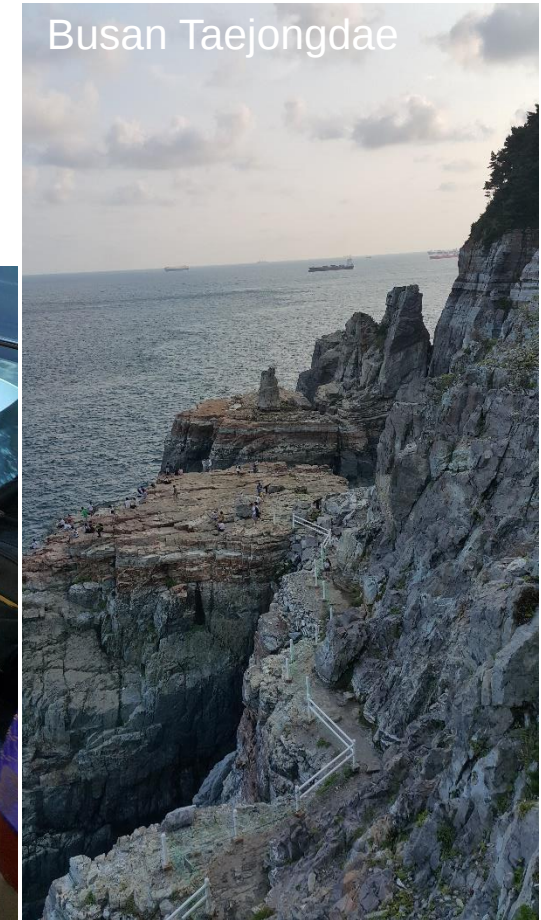


Daegu/SungJin Fo-Ma & Ulsan/Hyundai Motors & Busan

SungJin Fo-Ma



Tight schedule
& hardest day



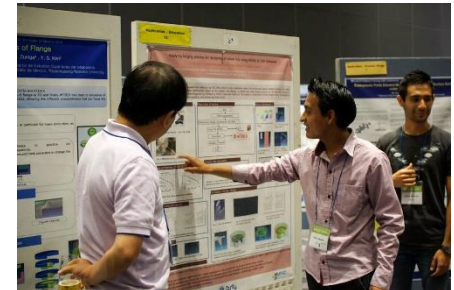
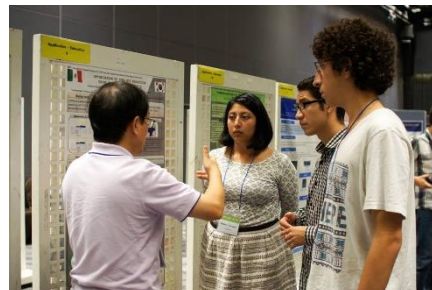
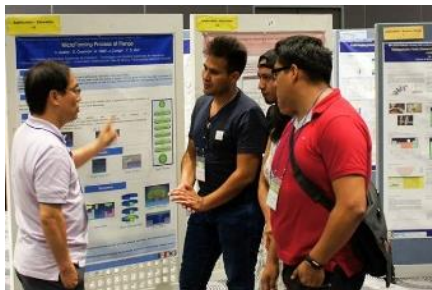
Busan Taejongdae

Hyundai Motors



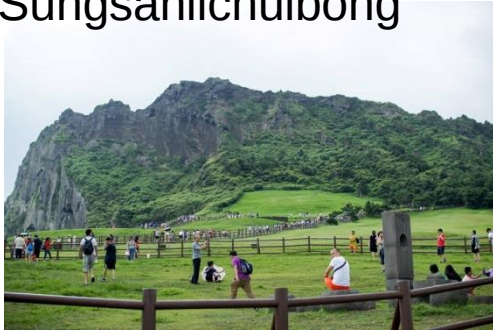
Hot cod soup

MFCAE 2016 – an International Metal Forming CAE Conference 2016



Jeju Volcanic Island Tour

Sungsanilchulbong



Subjicoji



Unfortunately we see only 2%.

We were together

at **GISPAM 2016**



Participants Survey Result for GISPAM 2016

Curriculum

1: Poor, 2: Average, 3: Good, 4: Very Good, 5: Excellent. (Unit : Persons)

		1	2	3	4	5
1	Orientation				4	16
2	Basic mathematics, Statics, Solid mechanics				1	19
3	Solid mechanics II, Foundations of heat transfer, FEM				1	19
4	3D CAD Basic, Advanced, Practice			1		19
5	AFDEX 2D Basic & Practice				3	17
6	AFDEX 3D Basic & Practice				3	17
7	MAPS-3D				4	16
8	RecurDyn		1	1	3	15
	Total	0	1	2	19	138

Facilities & Service

1: Poor, 2: Average, 3: Good, 4: Very Good, 5: Excellent. (Unit : Persons)

		1	2	3	4	5
1	The quality of the dormitory cafeteria (Breakfast, Dinner)		1	8	4	7
2	The quality of the staff restaurant (Lunch)			4	7	9
3	The quality of the student dormitory			1	5	14
4	The quality of education places				3	17
5	Support of managers			1	5	14
	Total	0	1	14	24	61

Curriculum

1: Poor, 2: Average, 3: Good, 4: Very Good, 5: Excellent. (Unit : Persons)

		1	2	3	4	5
1	GTIC & KITECH (29th Jul.)				3	17
2	POSCO (29th Jul.)				2	18
3	Jinju city tour (23th Jul.)				3	17
4	Busan city tour (30th Jul.)				2	18
5	Namhae, Sangju Beach (6th Aug.)				2	18
6	Seoul city tour (13~15th Aug.)				1	19
7	Gyeongju city tour & Culture experience (16~17th Aug.)				3	17
8	Sungjin FO-MA (16th Aug.)				2	18
9	Hyundai car factory (17th Aug.)				1	19
10	MFC AE 2016 (18th Aug.)				2	18
11	Jeju city tour (19th Aug.)				2	18
	Total	0	0	0	23	197

Facilities & Service

1: Poor, 2: Average, 3: Good, 4: Very Good, 5: Excellent. (Unit : Persons)

		1	2	3	4	5
1	Do you recommend GISPAM 2016 to your friends?				2	18

Average in total for each evaluation item

1: Poor, 2: Average, 3: Good, 4: Very Good, 5: Excellent. (Unit : Persons)

		1	2	3	4	5
	Curriculum	0.00	1.00	1.00	2.71	17.25
	Facilities & service	0.00	1.00	3.50	4.80	12.2
	Tour	0.00	0.00	0.00	2.09	17.91
	Satisfaction	0.00	0.00	0.00	2.00	18.0



Adiós GISPAM2016