2024 International Conference on Applied Mathematics, Modeling and Computer Simulation (AMMCS 2024)

Entrepreneurship in the Automotive Industry Using Computational Modeling Technology

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Introduction

- Successful engineering projects always rely on leading standards to achieve excellence in design and manufacturing in order to achieve appropriate economic growth, especially in an economy that depends on industry, of course with making profits.
- This is in light of the era of the Fourth Industrial Revolution (IR4.0) by adopting digital computing technologies as a way of life within information technology (IT) in the seven major industrial countries [1-3].
- Digital industry technologies are the manufacturing of products based on the automation of design and manufacturing processes according to new innovations studied by entrepreneurs [3-4].
- Hence, the prosperity of the economy, especially the economy that depends on industry, requires the advancement of information technology sciences such as computational and simulation technology in design, manufacturing, and production, especially in automotive internal compassion engines (ICEs) [5].

Research objectives

- **Using entrepreneurship in the automotive industry using computer modeling technology and rationalizing support to improve the investment environment thanks to information technology**
- **Measuring the ability of the entrepreneur, through what researchers and specialized thinkers have reached, studies have confirmed that the distinguished entrepreneur is the one who brings his idea to form a successful company or project.**

Methods

- The work in this paper is concerned with advanced technology in developing the design of complex systems.
- The work plan in this research focuses on two main axes: entrepreneurship and information technology for sustainable development using advanced technology such as computational methods and effective modeling in design for manufacturing.
- In addition to the importance of focusing on the tireless efforts that some countries are seeking to achieve maximum benefit from the concept of entrepreneurship throughout history to keep pace with the digital age in design and manufacturing to support and flourish the economy. This is according to:

Fig.1. Meshing of proposed simulation

Mesh settings:

Avg. Element Size (fraction of model diameter)	0.1
Min. Element Size (fraction of avg. size)	0.2
Grading Factor	1.5
Max. Turn Angle	60 deg
Create Curved Mesh Elements	No
Use part based measure for Assembly mesh	Yes

Fig. 2. Prototype of 3D simulation model

Numerical simulation

Group I:
Aluminium,
Steel cast,
Steel alloy;
Steel carbon

Result Summary

Name	Minimum	Maximum
Volume	302.087 in^3	
Mass	55.6036 lbmass	
Von Mises Stress	0.000002794811 ksi	0.868475 ksi
1st Principal Stress	-0.226755 ksi	0.396034 ksi
3rd Principal Stress	-1.07744 ksi	0.0613745 ksi
Displacement	0 in	0.000264007 in
Safety Factor	15 ul	15 ul
Stress XX	-0.507076 ksi	0.381648 ksi
Stress XY	-0.141281 ksi	0.142329 ksi
Stress XZ	-0.223704 ksi	0.221432 ksi
Stress YY	-0.527538 ksi	0.396033 ksi
Stress YZ	-0.376869 ksi	0.361233 ksi
Stress ZZ	-0.98487 ksi	0.35901 ksi
X Displacement	-0.0000102994 in	0.00000961237 in
Y Displacement	-0.0000180223 in	0.0000175669 in
Z Displacement	-0.000264004 in	0.0000000736275 in
Equivalent Strain	0.000000000172865 ul	0.0000541647 ul
1st Principal Strain	0.000000000007177266 ul	0.0000235216 ul
3rd Principal Strain	-0.0000618599 ul	-0.000000000150844 ul
Strain XX	-0.0000111685 ul	0.0000190655 ul
Strain XY	-0.00000905542 ul	0.0000102579 ul
Strain XZ	-0.0000204181 ul	0.0000292107 ul
Strain YY	-0.0000137096 ul	0.0000175051 ul
Strain YZ	-0.0000343979 ul	0.0000329708 ul
Strain ZZ	-0.0000537913 ul	0.00000924969 ul
Contact Pressure	0 ksi	0.377279 ksi
Contact Pressure X	-0.0548241 ksi	0.104763 ksi
Contact Pressure Y	-0.158508 ksi	0.158401 ksi
Contact Pressure Z	-0.283232 ksi	0.35812 ksi

Material(s)

Name		
Titanium		
General	Mass Density	0.162934 lbmass/in^3
	Yield Strength	39972.4 psi
	Ultimate Tensile Strength	49965.5 psi
Stress	Young's Modulus	14911.3 ksi
	Poisson's Ratio	0.361 ul
	Shear Modulus	5478.08 ksi
Part Name(s)	Crankshaft.ipt base_sketch of main_assembly.ipt Connecting Rod cap.ipt Connecting Rod.ipt	
Steel		
General	Mass Density	0.283599 lbmass/in^3
	Yield Strength	30022.8 psi
	Ultimate Tensile Strength	50038 psi
Stress	Young's Modulus	30457.9 ksi
	Poisson's Ratio	0.3 ul
	Shear Modulus	11714.6 ksi
Part Name(s)	piston.ipt	
Steel, Carbon		
General	Mass Density	0.283599 lbmass/in^3
	Yield Strength	50763.2 psi
	Ultimate Tensile Strength	60915.8 psi
Stress	Young's Modulus	29007.5 ksi
	Poisson's Ratio	0.29 ul
	Shear Modulus	11243.2 ksi
Part Name(s)	piston pin.ipt	
Steel, Alloy		
General	Mass Density	0.279264 lbmass/in^3
	Yield Strength	36259.4 psi
	Ultimate Tensile Strength	58015.1 psi
Stress	Young's Modulus	29732.7 ksi
	Poisson's Ratio	0.3 ul
	Shear Modulus	11435.7 ksi
Part Name(s)	piston ring.ipt	

Fig.3. Specification of group and their summary

Group II:
Titanium,
Steel,
Steel-carbon,
Alloy steel

Material(s)

Name	Aluminum	
General	Mass Density	0.0975437 lbmass/in^3
	Yield Strength	39885.4 psi
	Ultimate Tensile Strength	44961.7 psi
Stress	Young's Modulus	9993.1 ksi
	Poisson's Ratio	0.33 ul
	Shear Modulus	3756.8 ksi
Part Name(s)	piston.ipt base_sketch of main_assembly.ipt	
Steel, Cast		
General	Mass Density	0.283599 lbmass/in^3
	Yield Strength	36259.4 psi
	Ultimate Tensile Strength	43511.3 psi
Stress	Young's Modulus	30457.9 ksi
	Poisson's Ratio	0.3 ul
	Shear Modulus	11714.6 ksi
Part Name(s)	Crankshaft.ipt	
Steel, Alloy		
General	Mass Density	0.279264 lbmass/in^3
	Yield Strength	36259.4 psi
	Ultimate Tensile Strength	58015.1 psi
Stress	Young's Modulus	29732.7 ksi
	Poisson's Ratio	0.3 ul
	Shear Modulus	11435.7 ksi
Part Name(s)	piston ring.ipt piston pin.ipt	
Steel, Carbon		
General	Mass Density	0.283599 lbmass/in^3
	Yield Strength	50763.2 psi
	Ultimate Tensile Strength	60915.8 psi
Stress	Young's Modulus	29007.5 ksi
	Poisson's Ratio	0.29 ul
	Shear Modulus	11243.2 ksi

Result Summary

Name	Minimum	Maximum
Volume	302.087 in^3	
Mass	79.5006 lbmass	
Von Mises Stress	0 ksi	2.49361 ksi
1st Principal Stress	-0.353927 ksi	1.62506 ksi
3rd Principal Stress	-2.22138 ksi	0.285198 ksi
Displacement	0 in	0.000561986 in
Safety Factor	14.541 ul	15 ul
Stress XX	-1.34236 ksi	1.6241 ksi
Stress XY	-0.848885 ksi	0.876562 ksi
Stress XZ	-0.478544 ksi	0.4748 ksi
Stress YY	-1.42189 ksi	1.36327 ksi
Stress YZ	-0.582177 ksi	0.599309 ksi
Stress ZZ	-1.08279 ksi	1.35014 ksi
X Displacement	-0.0000699941 in	0.0000698945 in
Y Displacement	-0.0000671661 in	0.0000676983 in
Z Displacement	-0.000561986 in	0.00000350229 in
Equivalent Strain	0 ul	0.000125364 ul
1st Principal Strain	-0.0000000000107024 ul	0.0000840663 ul
3rd Principal Strain	-0.000139416 ul	0.0000000000452922 ul
Strain XX	-0.0000848262 ul	0.0000660213 ul
Strain XY	-0.0000453862 ul	0.0000456756 ul
Strain XZ	-0.0000483043 ul	0.0000472096 ul
Strain YY	-0.0000953069 ul	0.0000703981 ul
Strain YZ	-0.0000559899 ul	0.0000557506 ul
Strain ZZ	-0.000139413 ul	0.0000833526 ul
Contact Pressure	0 ksi	1.41264 ksi
Contact Pressure X	-0.587106 ksi	0.622041 ksi
Contact Pressure Y	-0.467994 ksi	0.519444 ksi
Contact Pressure Z	-1.25639 ksi	1.24146 ksi

Fig.4. Specification of group II and their summary

Results

3D Modeling of the Two best Materials using Computational Technology

Group I:
Aluminium,

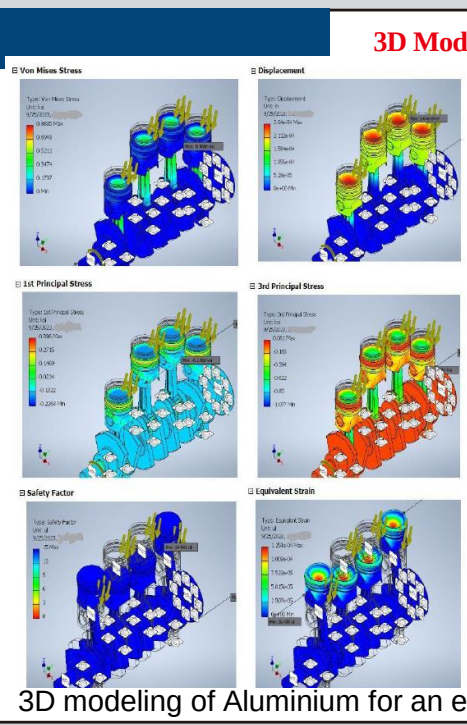

Fig 5. 3D modeling of Aluminium for an engine

Group II:
Titanium,

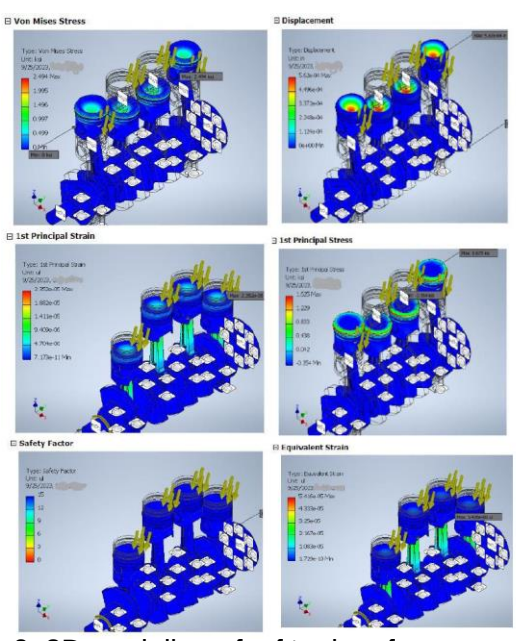

Fig. 6. 3D modeling of of tanium for an engine

Conclusions

- Itis time to maximize the benefit from computing modeling and entrepreneurship technologies in the field of sustainable development projects such as automotive design to manufacturing.
- Encouraging the use of information modeling technology to be more suitable for enhancing design and manufacturing.
- The materials could be used to increase the thermal distribution coefficients and thus reduce the risk of thermal stress and deformation, and the material titanium was the best of all. Moreover, the chances of engine failure and stress could be significantly reduced, thus ensuring optimum performance and longevity of its vehicle.
- It is time to study the ISO standard for unified classification of computing modeling technology, to maximize their benefits.

Acknowledgement

The authors expresses his appreciation for who prepared the CAD..

References

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