



Redesign of A Suspension Upright For Increased Volume production For the Chinese Market

Alireza Mahdiyazadeh

Kelvin Lake
School of Engineering
BEng Motorsport Engineering

Introduction

For this project the front Suspension Upright from the Zen Track has been chosen to be analyzed.

The UK car manufacturing has been compared to the Chinese car manufacturing from low to high volume to analyze the strategy and points that they are using to reduce the cost and increase the volume with standard quality.

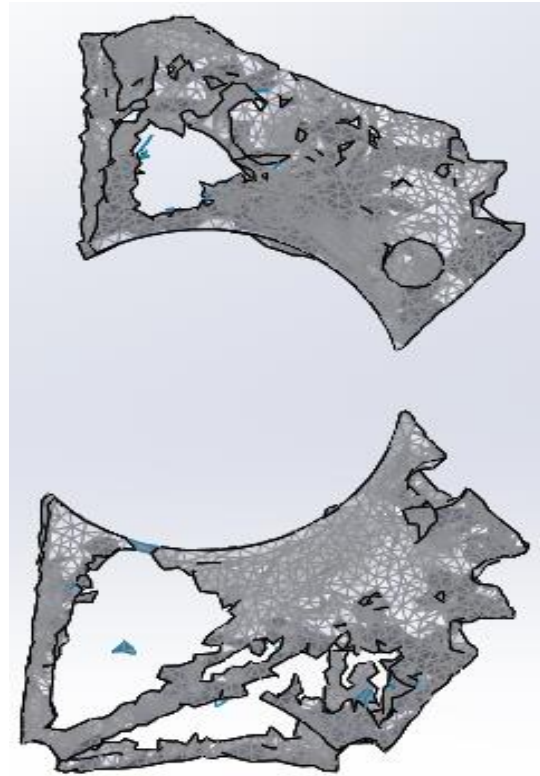
To take the production to the Chinese market and reduce the cost three facts need to be analyzed:

1. Light weighting and using less material
2. Material choice
3. Manufacturing technique

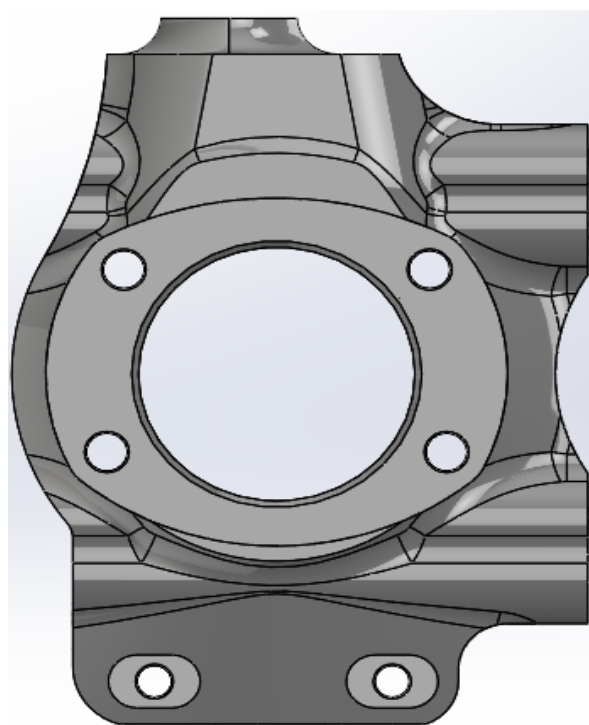
Light weighting or weight reducing

Steps to reduce the Upright weight and redesign the component:

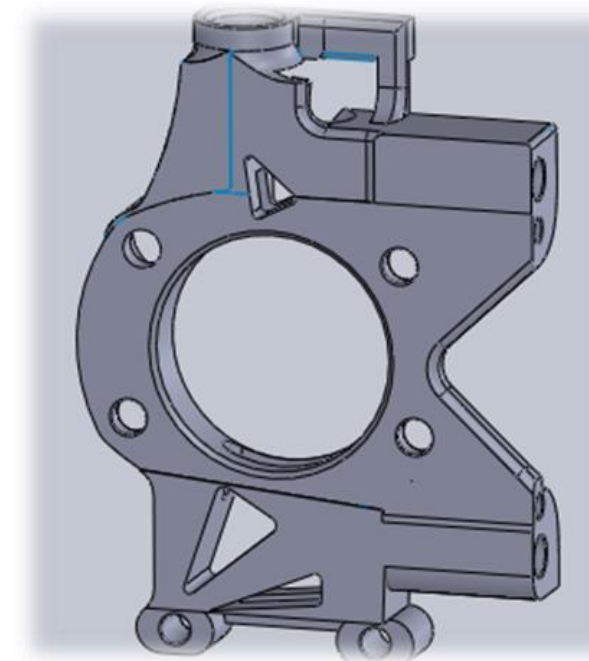
- Original model physical static test
- Original model FE model
- Comparison between physical and FEA test to find the original upright material
- Create the packaging space
- Set the packaging space into the GENESIS soft wear and run
- Three different weight percentage have been run at 30%, 13% and 9%
- Import the result into the solid works to design the new upright
- End up with two different design with different shape and material usage
- New designed upright FE model
- Comparison between the original upright FEA test and new design FEA test



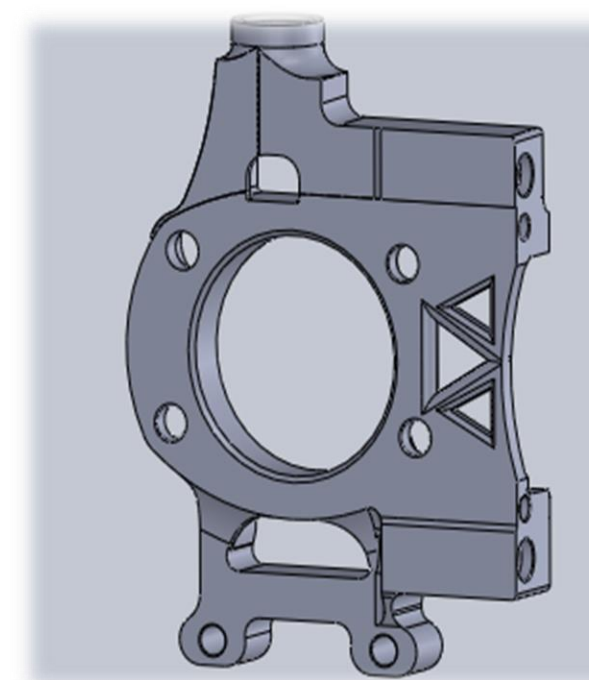
This figure is the result of topology optimization and it is the structure of the new upright that shows how much and where the material need to be to design the new upright.



Original Zen Track suspension upright



First Suspension upright design with complex shape and high cost of manufacturing



Second and final design to reduce the cost of manufacturing

Materials

Analyse the three different possible material for the upright which is:

1. Aluminium and aluminium alloys
2. Magnesium
3. Cast iron

Material compression	Magnesium VS aluminium	Cast iron VS aluminium
density	Lower	Higher
stiffness	Lower	Higher
price	Higher	Lower

Manufacturing Technique

1. Lost-wax casting to manufacture both of the designs
2. Sand casting
3. Centrifuge casting
4. Squeeze casting
5. Forging

Cost and manufacturing	Sand casting	Centrifuge casting	Squeeze casting	forging	Lost-wax casting
Unit cost	£20	£22	£21	£27	£23
Units/hour	20	200	60	300	100
Tools cost	£10	£100	£500	£3000	£45
Units produced / tool	10	90	100000	100000	8
Tooling cost / unit	£1	£1.11	0.5p	3p	£5.63
machining	£15	£15	£11	£13	£21
drilling	£8	£8	£8	£8	£8
threading	£4	£4	£4	£4	£4
Unit cost	£48	£50.11	£44	£52.03	£61.60

Edu pack, C. (2018). CES Edu pack. Swansea: UWTSD.

Braking and wishbone forces

Brake and wishbones forces have been calculated while measured the weight of the Zen Track and height from ground to the wishbones to create the FE model of the new upright design.

Conclusion

- FEA test with real calculated forces have been done and end up with excellent result
- 20% of the weight have been reduced
- 100.000 upright plane to produce a year so squeeze casting will be chose for the manufacturing technique with cost of £44 per unit
- Aluminium alloy-6061 is one of the best choice for the upright

Acknowledgements

Work shop assistances

References

sun, I. y. (2017). the next factory of the world. London.

L.Rooy, J. G. (2004). aluminium alloy casting. THE USA: ASM international & AFS.

I.Isayev, A. (1987). injection and compression moulding fundamental. New York: Marcel Dekker/ Inc.

Sigmund, D. t. (2003-2004). topology optimization. Lync by: Springer.