Design Optimisation

op·ti·mi·sa·tion *n.* – “The procedure or procedures used to make a system or design as effective or functional as possible, especially the mathematical techniques involved.”

What is Design Optimisation?

As the definition suggests, optimisation means maximising performance, or finding the best trade off between various parameters. Apply this to design or engineering work and it usually means maximising strength or stiffness, while minimising weight and cost.

What does this have to do with me?

If you’re involved in component design or manufacture, or you just have something you want to make lighter, stronger, or just improve its performance, then design optimisation is something you should know about.

With a variety of computer simulation tools already being widely used in engineering to help improve designs, a new set of tools is emerging to further speed up the design process and come up with truly optimal solutions. These tools are being used by the major players in automotive and aerospace industries worldwide, and now Bremar Automotion is bringing them to you.

Tell me more...

Traditional methods of design optimisation involved a process of manual design iterations based on a cycle of design-build-test-improve… basically trial and error. This would generally be done by building physical prototypes to test and then improve upon. Computer Aided Engineering (CAE) is now being used more to ‘virtually’ build and test prototypes, however this still involves numerous manual iterations to improve a design and may still never achieve an optimal solution.

A field of engineering known as Multidisciplinary Design Optimisation (MDO) is now emerging that leverages off existing CAE tools, but significantly reduces the amount of manual iterations and human input into a design. It’s a mouthful, but don’t be put off by the title… this is powerful stuff and will give you better designs quicker than you ever thought possible.

Described simply, these optimisation techniques still go through a number of design iterations, however the iterations are performed automatically by the optimisation software. Rather than the engineer or designer taking an educated guess as to the changes for the next design iteration, the software uses numerous mathematical techniques in the background to make a calculated decision on what changes should be made to move the design in the right direction, giving you an ideal solution in less time.

The optimal solution that the software comes up with can often be quite non intuitive – you would never have done it that way yourself, but the concepts are sound and your designs take on a unique and functional appearance while meeting all its performance requirements.

- *Would you benefit from designing lighter, stronger parts?*
- *How much development time do you spend going through manual design iterations and testing?*
- *Could you benefit from improved designs with reduced lead times?*

Optimisation Benefits

- *Reduced design times*
- *Reduced development costs*
- *Truly optimal designs*
- *Improved part reliability*
- *The ‘winning edge’ for motorsport*
- *Non intuitive solutions*

For more information and examples of design optimisation in action, go to:

www.bremarauto.com/optimisation.htm

Contact us now and let us work with you to find solutions to your CAE problems & benefits for your business.

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So what sort of things can be optimised?

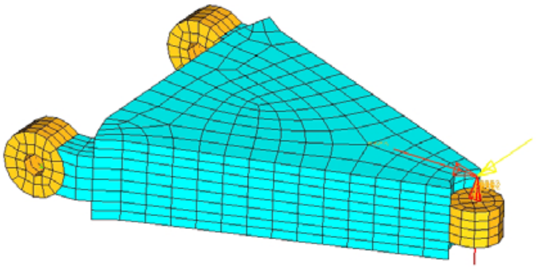
Basically anything that you've previously designed or improved by the old trial and error approach can benefit from MDO. Below is just a few examples of what can be optimised using these techniques:

- minimise part mass while meeting strength or stiffness targets
- maximise stiffness or strength for a given mass
- the best layout for reinforcement ribs in sheet metal pressings
- the best member sections or sheet gauge to use for minimum weight
- the ideal locations for joints in a mechanism to achieve a desired motion, such as suspension kinematics or steering systems
- ideal ply orientation in composite layups for maximum strength
- maximising or tuning modal vibrations to a specific frequency

Generally, if your problem can be simulated, then it can be optimised and about the only limitation is your imagination.

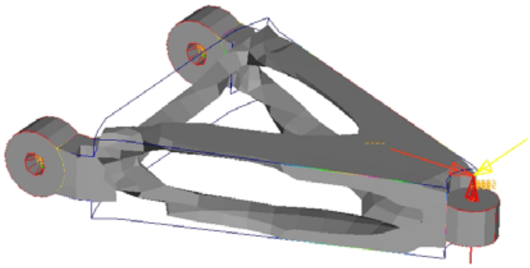
How does it work then?

Here's a brief example of an optimisation on a suspension control arm.



The orange areas are the inner pivot points and ball joint connections which are fixed by the suspension geometry and can't be changed, while the blue part is a solid volume of material that the software is allowed to cut away. There's also 3 separate loads applied to the part to represent braking, cornering, and hitting a pothole.

The optimisation software was set up to find the ideal material layout to give the minimum mass for the control arm, but be stiff enough not to let the ball joint move more than 0.1mm for any of the load cases. Here's what it came up with in a matter of minutes:

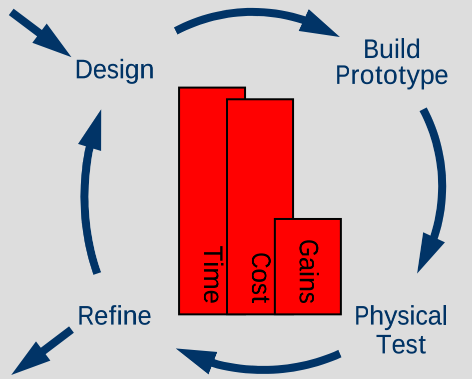


As you can see, a distinct form has taken shape and with some further refinement and development, the part would soon be ready for manufacture. And before you even reach for the tools, you could be confident in the knowledge that it's not only light, but will meet all its other performance targets as well.

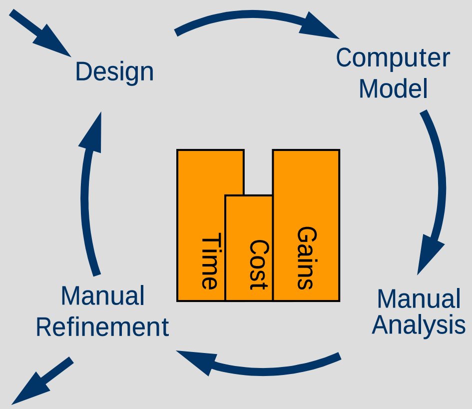
This is just one simple example of how these design optimisation techniques can be applied. So if you're already seeing the benefits and would like to know more, contact us now for a no obligation demo and discussion about applying these techniques to your design process. What have you got to lose?

Design Cycle Comparison

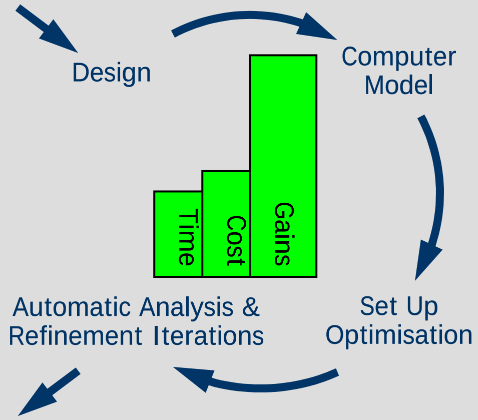
:: Physical Testing Design Cycle



:: Manual CAE Design Cycle



:: CAE Optimisation Design Cycle



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