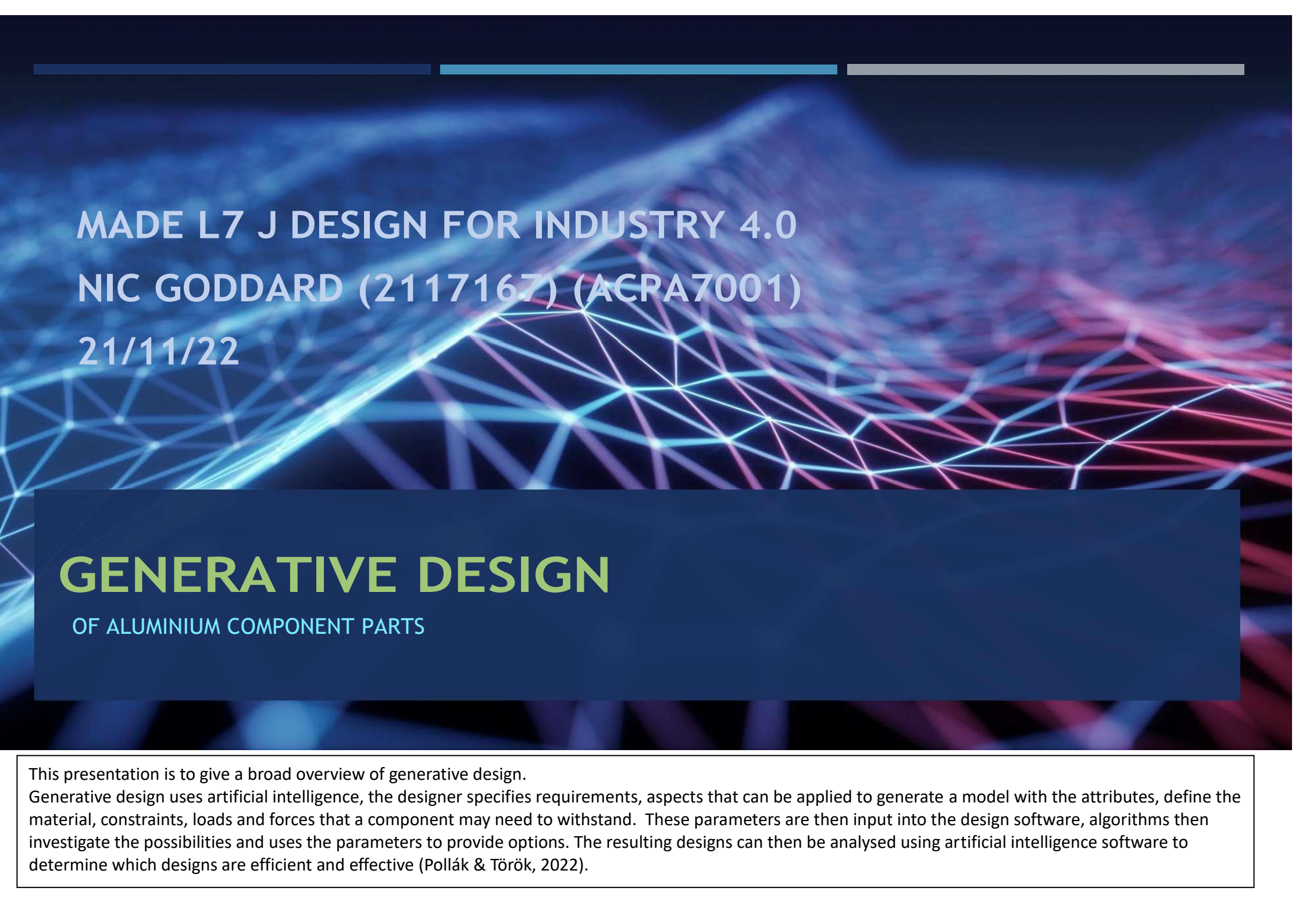




MADE L7 J DESIGN FOR INDUSTRY 4.0

NIC GODDARD (2117167) (ACPA7001)

21/11/22

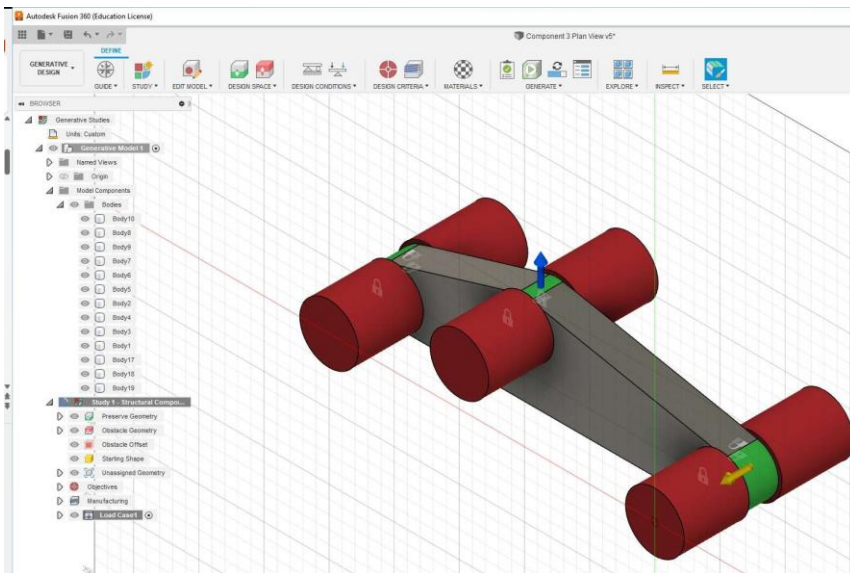
GENERATIVE DESIGN

OF ALUMINIUM COMPONENT PARTS

This presentation is to give a broad overview of generative design.

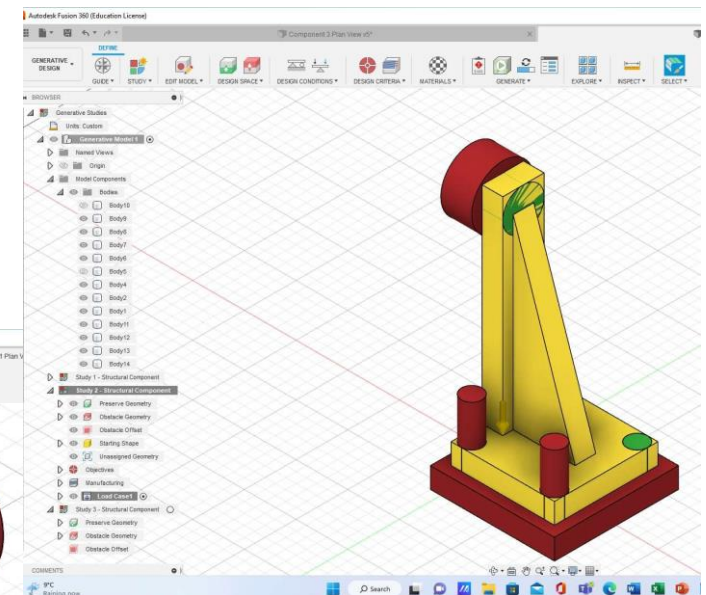
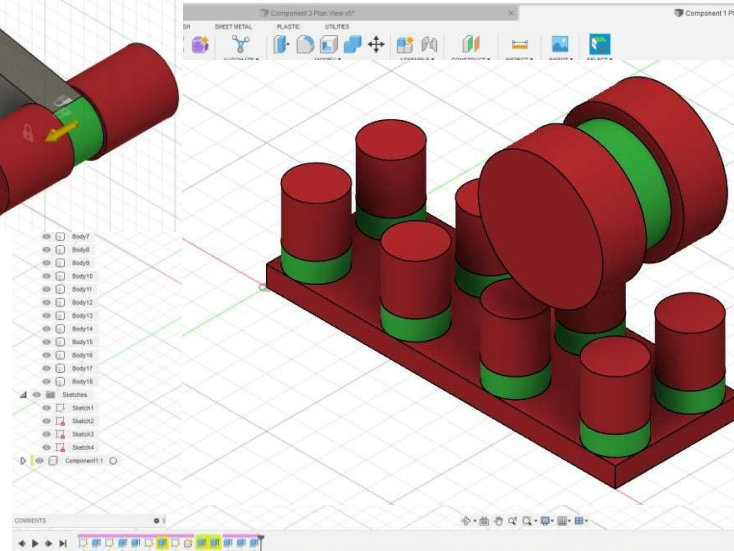
Generative design uses artificial intelligence, the designer specifies requirements, aspects that can be applied to generate a model with the attributes, define the material, constraints, loads and forces that a component may need to withstand. These parameters are then input into the design software, algorithms then investigate the possibilities and uses the parameters to provide options. The resulting designs can then be analysed using artificial intelligence software to determine which designs are efficient and effective (Pollák & Török, 2022).

EXAMPLES OF MODELS CREATED USING AUTODESK FUSION 360



Lesson learnt from the example above, is that too many structural constraints were in place.

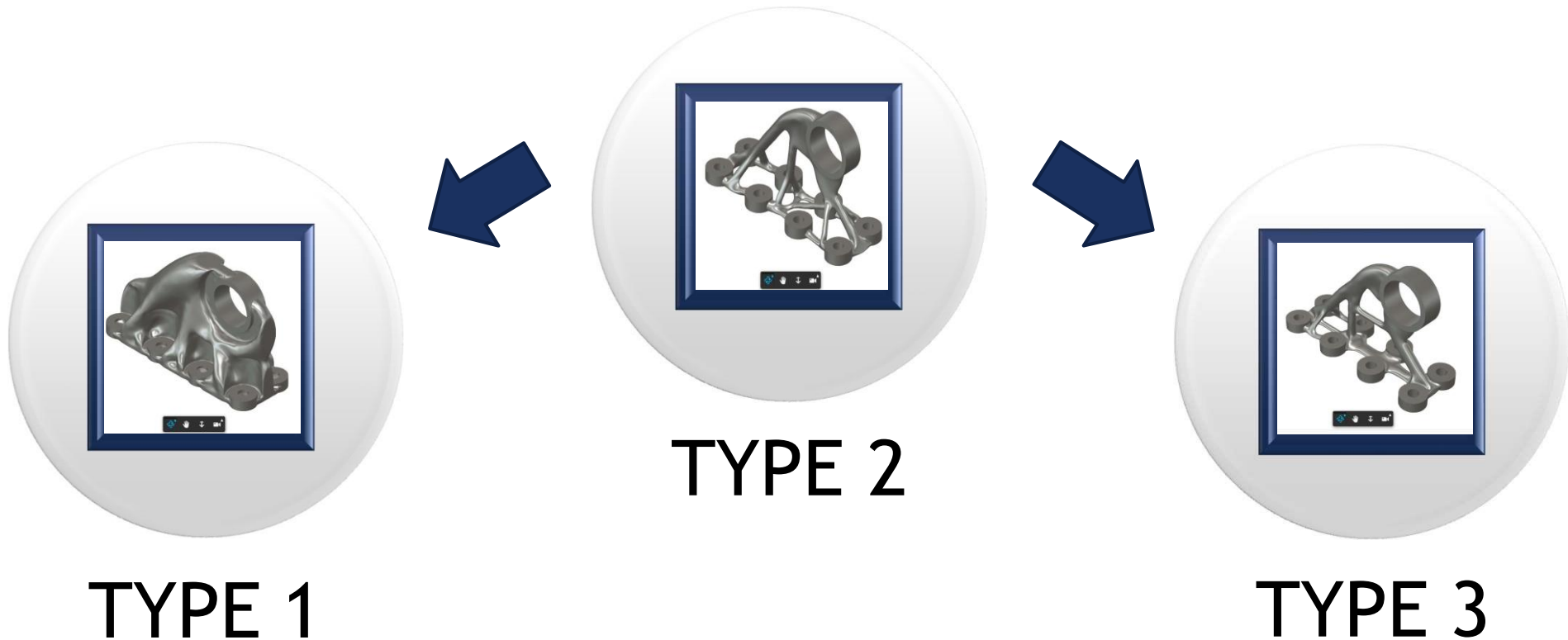
Lesson learnt from the example below, was to be able copy and paste a load case to enable application of different forces for each load case study.



Lesson learnt from the example above, is the ability to be able to change colours of the structure, which could be useful in complex designs.

I decided to model up all three of the test pieces before deciding which to pick for a more in-depth study, in order to get a clearer understanding of the potential and capabilities of the design features of the software. Autodesk 360 is first in this field, incorporating 3D CAD, CAM and CAE cloud based processing (Verma & Weber, Autodesk Fusion 360 Black Book - Part 1, 2023).

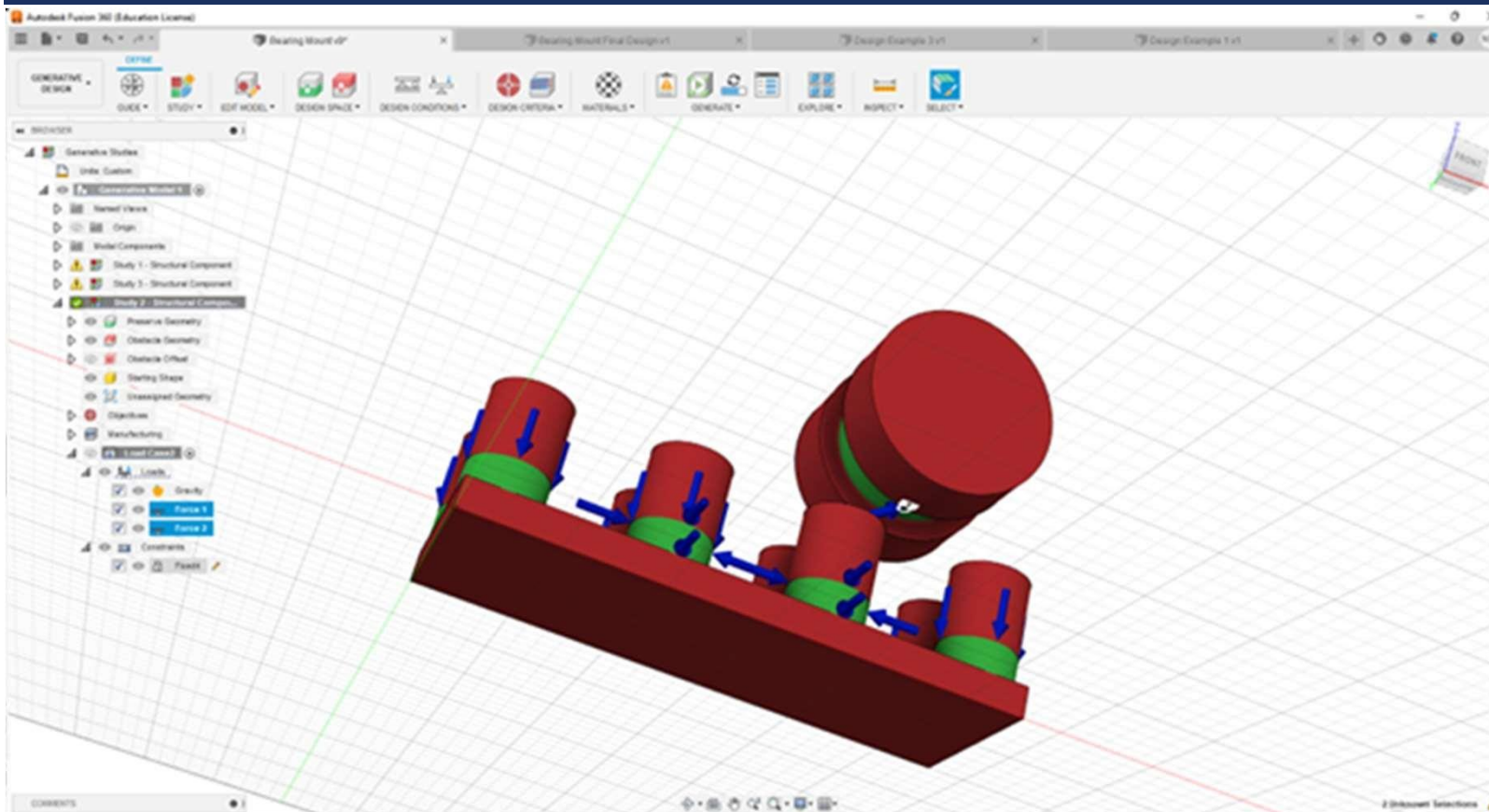
CHOOSING A DESIGN



Use of generative design in manufacturing saves a lot of time, producing structures that are effective and efficient, also saving money by providing cost effective manufacturing solutions (Schwartz, Raslan, Korplija, & Mumovic, 2021). Generative design is not limited to individual components but can be applied to multiple structures (Pollák & Török, 2022).

Choice of design is in part dependent of the application.

PROVISIONAL STUDY RESULTS



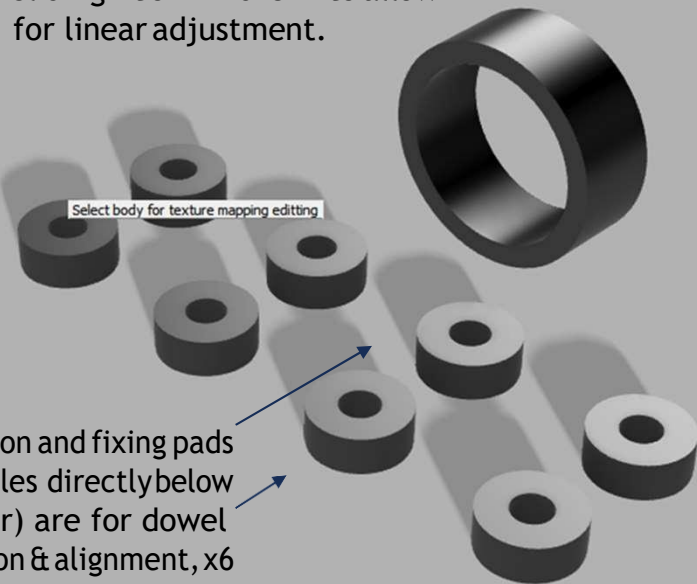
Generative Design Case Studies

- Study 1 flagged some design irregularities for design type 1.
- Study 2 however provided a positive result for design 2.
- Study 3 provided results for design type 3 also showing irregularities as with Study 1.

In this slide forces, loads and constraints can be seen. Where, how and what are applied will determine the outcome of the generative design processing (Verma & Weber, Autodesk Fusion 360 Black Book - Part 1, 2023).

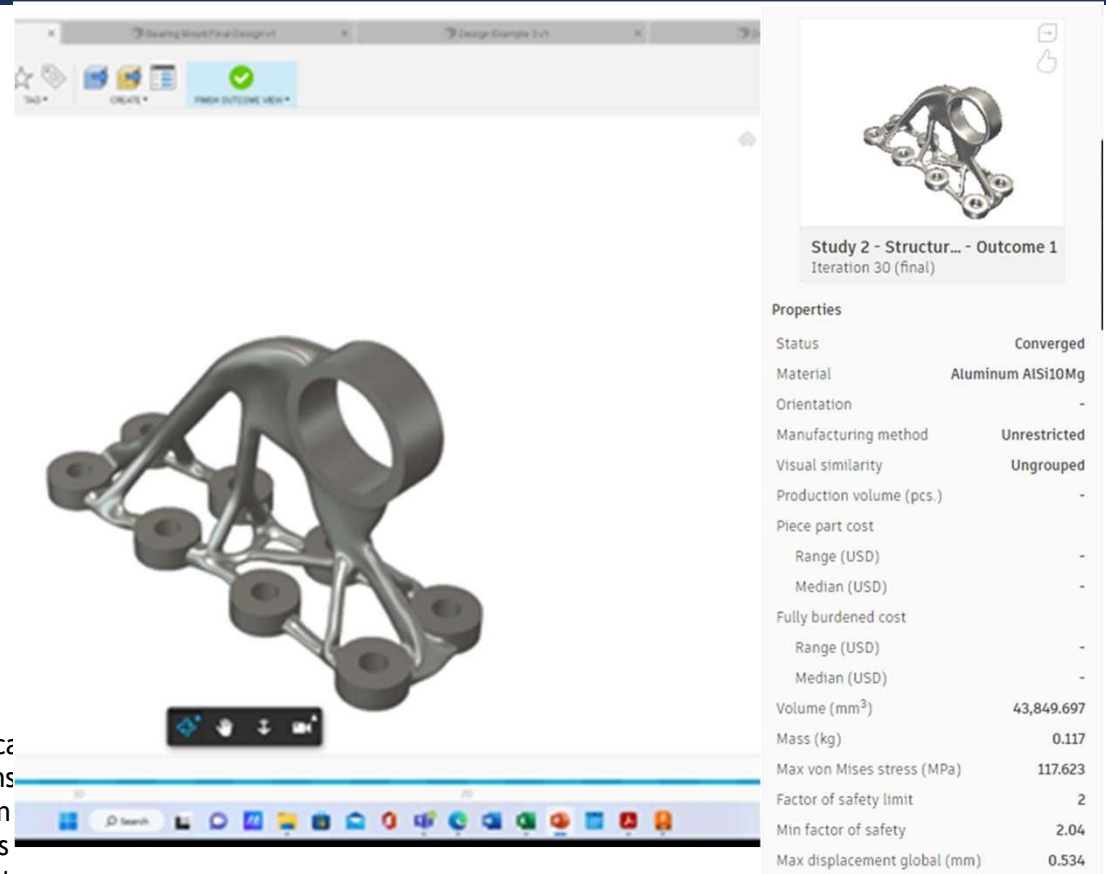
GENERATIVE DESIGN STUDY

Bearing Carrier, machined for sliding fit of x2 F625ZZ to allow for linear adjustment.



Location and fixing pads (x2 holes directly below carrier) are for dowel location & alignment, x6 holes for bolting down

Generative design feature allows for multiple studies of a designed component carried out, whereby variables such as load forces, direction of forces, and constraints can be input. A base line can be established, recorded and saved, further studies can then be carried out, changing the values compare whether or not the alterations improve the design, with considerations for strength, weight, manufacturability, cost, etc.



As can be seen in this slide the intention is for use as a bearing support carrier. Two holes have been identified for alignment use in to ensure the component is alignment is controlled preventing any miss-alignment with associated components that could result in abnormal wear, stresses or loads that could result premature failure.

MANUFACTURING

There are three most likely manufacturing process for this type of component.

1. Removal of material.
2. Casting, which would require minimal removal of material.
3. Additive, which again would require minimal removal of material.

In the latter two methods machining would most like only be require as a finishing process for final fit process or function if deemed necessary.

Which is the best method? Some factors to consider are, quality, material, quantity and quality.

If the component were a one of for development, then either 1 or 3 should be considered.

If the part was for mass production the 2 would most likely be an ideal solution.

Whichever method is chosen, the results of the manufacturing process would meet the design criteria for intended use.

The points displayed demonstrate some of the benefits possible through use of Additive Manufacturing as opposed to conventional methods. The combination of generative design and use of additive manufacturing has provided significant breakthroughs in the medical and surgical sectors, from surgical aides, bone implants (Zhang, et al., 2021) and exoskeletal supports (Ricotta, Campbell, Ingrassia, & Nigrelli, 2020). Additive Manufacturing has multi-faceted enhancements that can have substantial and significant reductions to a carbon footprint.

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