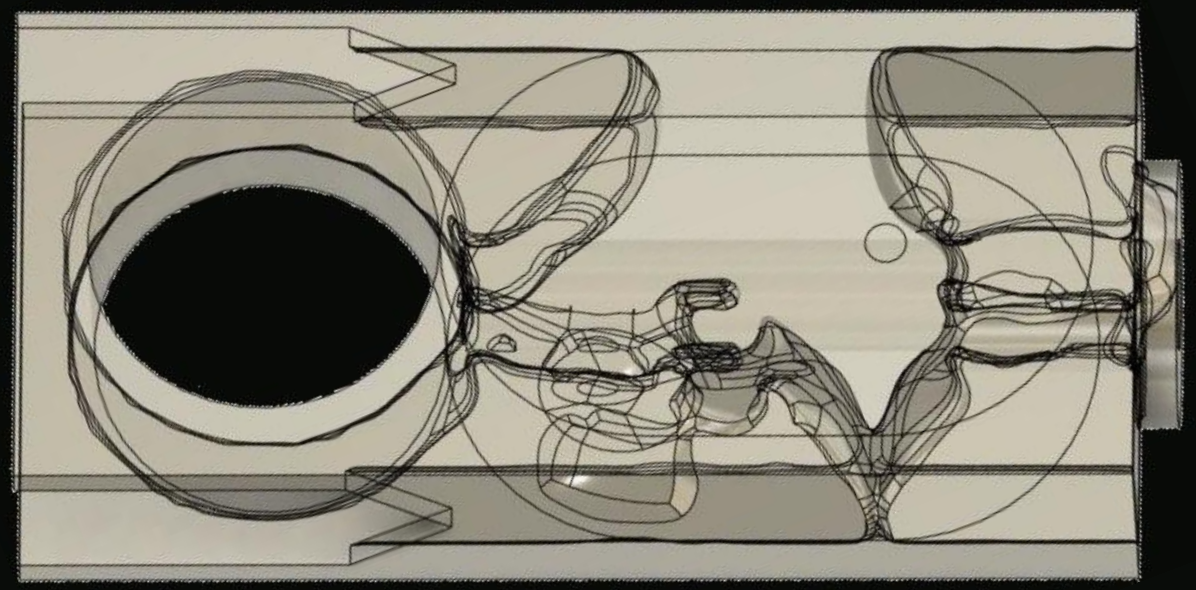
Additive Manufacturing & Generative Design

Additive Manufacturing

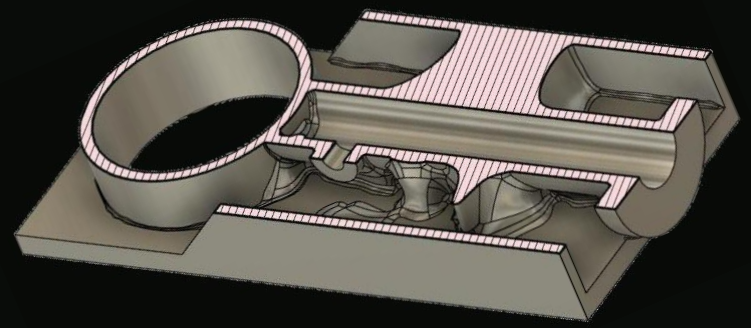
- Reduces waste significantly from traditional subtractive manufacturing
- Reducing lead times means less reliance on holding stock
- Stock simplified to base materials; no stock form/size holding
- Environmental impact of traditional manufacturing and the transition to net zero
- Geometric design freedom that is impossible with traditional manufacturing
- Reduces material usage by only placing material where needed

Generative Design of a Valve Gate

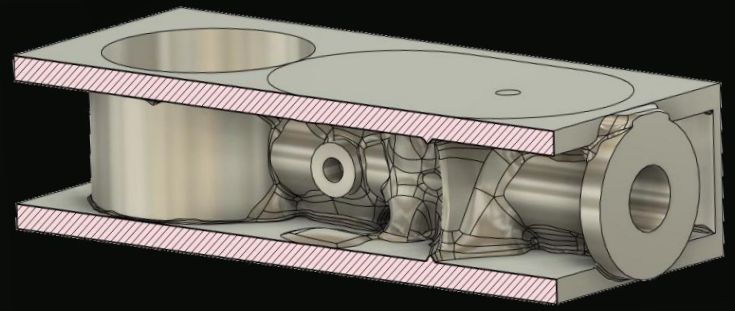
- **Software generates internal structure to maintain the strength of a solid component whilst minimizing material usage**
- **Creates structures only achievable with additive manufacturing**



Valve gate generative design internal structure



Section view: generative design internal structures

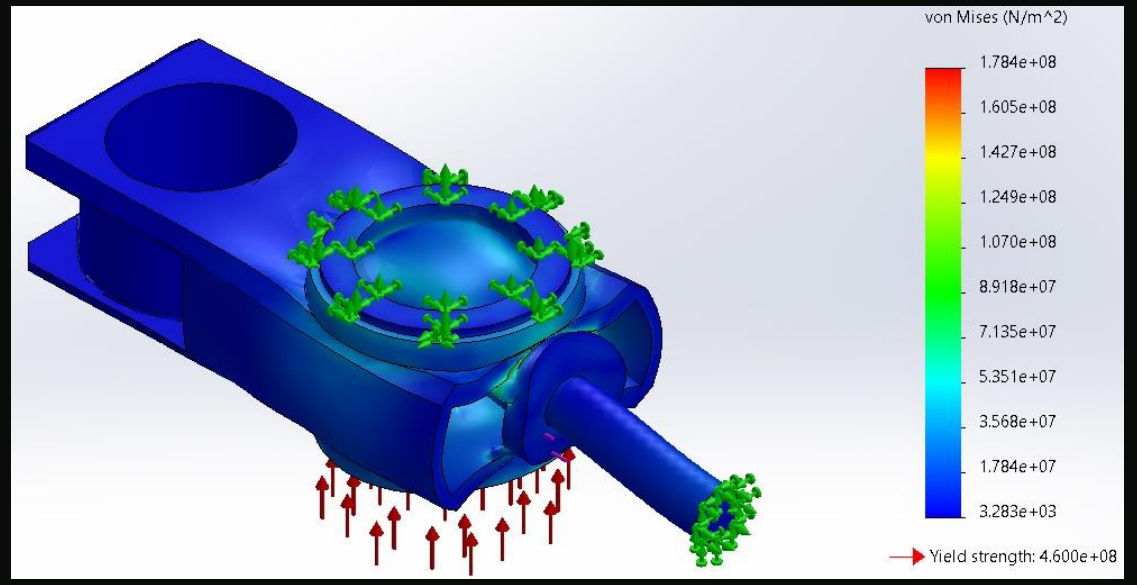


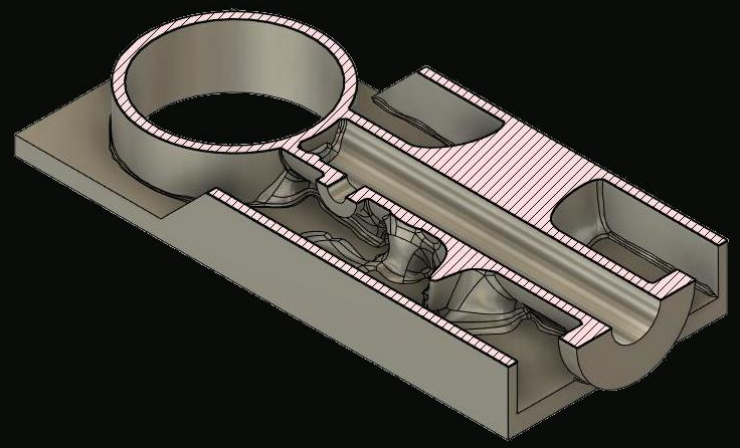
Section view: generative design internal structures

Unity

Generative Design for Additive Manufacturing

- Generative designs deliver FEA results in-line with solid constructions
- Saves up to 40% of material vs solid construction
- Design optimisation easily achievable
- Minimises construction processes involved only requiring final machining of surfaces





Additive Manufactured Components for Oil & Gas

- **Industry Drivers:**
- Environmental impact of traditional manufacturing and the transition to net zero
- Maximize production from existing brownfield wells, especially those with low tubing head pressure
- Reduce lead times and stock holding of critical spares
- Improve support for obsolete equipment
- Unity holds a patent for 3D printing of mono and split gates with internal structures (PA990736GB)

- Lloyd's Register was the first company to certify a 3D printed part for Oil & Gas use in 2017 and oversaw the entire project in order to achieve certification of the component
- DNV has published guidance notes for the certification of metallic parts made by additive manufacturing

Additive Manufacturing, The Future

Digital warehouse

Traditional warehouse

- **Supply chain efficiencies**:
  - Raw materials reduced
  - Transportation and waste reduction
  - Easily customised with complexity having little impact to cost
  - No reliance on large volume to reduce manufacturing costs
  - Significantly shorter lead times
  - Low labour costs
- Industry standards and **certification already exists**

Unity