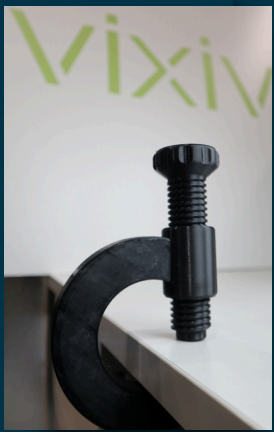
C-Clamp Case Study

Applicable Industries: Construction, Industrial

Overview

C-clamps are widely used tools in manufacturing, fabrication, and prototyping to apply compressive force to secure parts during assembly, machining, welding, and inspection. Traditional designs are typically made from ABS combined with aluminum or cast iron and feature solid, heavy infill structures that prioritize strength but result in excess weight and limited material efficiency.

This case study explores how Vixiv AI was used to optimize a C-clamp, achieving the desired stiffness and minimizing material usage without compromising structural integrity.



CHALLENGE

While most C-clamps are traditionally made from metal that is much stronger than Atomic PETG, they are often significantly overbuilt for their intended use and heavier than necessary. A 3D-printed PETG clamp offers a practical alternative for users who need a stiff and functional clamp but not the extreme durability of cast iron.

The Objective: Reduce mass while optimizing the C-clamp for the load and maintaining mechanical stiffness.

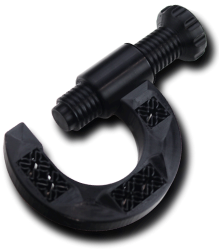
OPTIMIZATION WITH VIXIV AI

INPUTS

- **Domain**: Static Loading
- **Material**: Atomic Filament PETG Pro
- **Printer**: Prusa CORE One+
- **Shell thickness**: 0.11in (2.7mm)
- **Zero thickness direction**: None
- **Load:** 200 lbf

KEY RESULTS

- Passed **200 lbf** compression test
- 4 designs ready in **54 seconds**
- Up to **54%** mass reduction
  - Unlatticed: **135.2g**
  - Optimized 2.5D Structure: **62g**



IMPACT

With Vixiv AI, a C-clamp was optimized in under 54 seconds, cutting weight by up to 54% while maintaining stiffness and load capacity. The results prove that everyday parts are often overbuilt with traditional methods, and can be made lighter, stronger, and ready for additive manufacturing.

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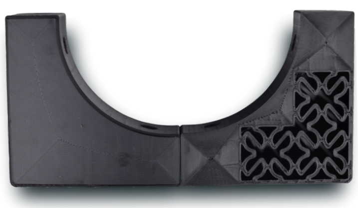
FDM Angle Bracket Case Study

Overview

Triangle (angle) brackets are used to join, support, or reinforce two perpendicular surfaces. For FDM users, these brackets are among the most frequently printed functional parts. They are used for shelves, enclosures, printer mods, jigs, camera mounts, and general around-the-house fixes. Most FDM-printed brackets rely on generic slicer infill settings chosen through trial and error. This often leads to parts that are heavier, slower to print, or weaker than necessary.

This case study explores how Vixiv AI was used to optimize an angle bracket for additive manufacturing, achieving significant weight reduction, stiffness improvement, and cost-efficiency without compromising structural integrity.



CHALLENGE

Traditional infills are not optimized for specific loads. When designing or printing brackets, infill is often set through trial and error. Too little infill risks failure, while too much wastes material and print time.

The Objective: Reduce part mass and print time while optimizing internal structure for a known load case to maintain mechanical stiffness, durability and eliminate reliance on slicer infill percentages.

OPTIMIZATION WITH VIXIV AI

INPUTS

- **Domain**: Static Loading
- **Material**: Atomic Filament PETG Pro
- **Printer**: Prusa CORE One+
- **Shell thickness**: 0.083in (2.1mm)
- **Load:** 350 lbf

KEY RESULTS

- **Passed** 350 lbf compression test
- 4 designs ready in **53 seconds**
- Up to **50%** mass reduction
  - Unlatticed: **123.79g**
  - Optimized 2.5D Structure: **61.93g**

IMPACT

With Vixiv AI, an angle bracket was optimized in 53 seconds, cutting weight by up to 50% while maintaining stiffness and load capacity. The results prove that everyday parts are often overbuilt with traditional methods, and can be made lighter, stronger, and more efficient designs for additive manufacturing.

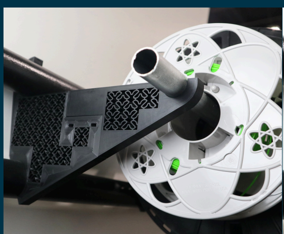
Filament Spool Holder Case Study

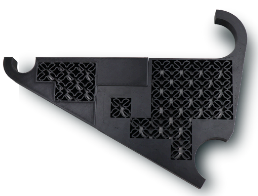
Applicable Industries: Hobbyist and Industrial 3D Printing

Overview

Filament spool holders are commonly used by both hobbyists and industry to hold multiple spools of filament at once. These spools are often heavy, and over time the constant load and bending forces can cause conventional holders to crack or fail, especially when infill density is guessed rather than engineered.

This case study explores how Vixiv AI was used to optimize spool filament holders, achieving the desired stiffness and minimizing material usage without compromising structural integrity.





CHALLENGE

Traditional infills are not optimized for specific loads. If the infill percentage is too low, the spool holder may crack or fail over time. If the infill percentage is too high, then unnecessary material and print time are wasted.

The Objective: Reduce mass while optimizing the holder for the load and maintaining mechanical stiffness.

OPTIMIZATION WITH VIXIV AI

INPUTS

- **Domain**: Static Loading
  Material: Atomic Filament PETG Pro
- **Printer**: Prusa CORE One+
- **Shell thickness**: 0.086in (2.2mm)
- **Zero thickness direction**: None
- **Load:** 50 lbf

KEY RESULTS

- Passed **50 lbf** compression test
- 13 designs ready in **80 seconds**
- Up to **54%** mass reduction
  - Unlatticed: **286.47g**
  - Optimized 2.5D Structure: **131g**

Spool holder contains 2 parts that are connected by screws to form one full piece.

IMPACT

With Vixiv AI, a spool holder was optimized in 80 seconds, cutting weight by up to 54% while maintaining stiffness and load capacity. The results prove that everyday parts are often overbuilt with traditional methods, and can be made lighter, stronger, and more efficient designs for additive manufacturing.

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