

Mazak Hybrid Multitasking

Joe Wilker

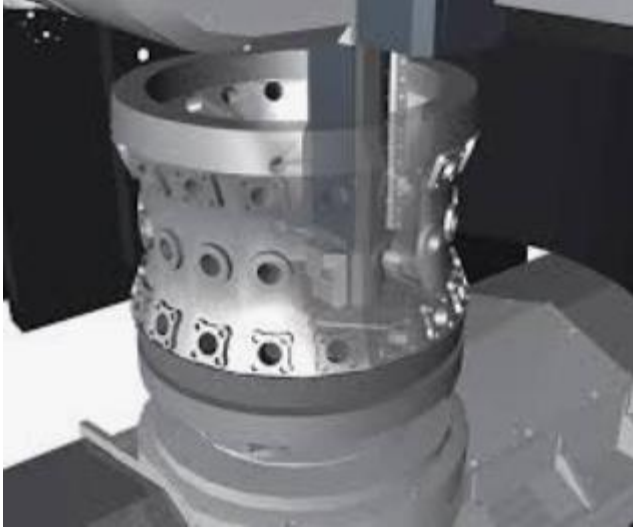
Advanced Multitasking Manager | Jwilker@mazakcorp.com

Mike Finn

Senior Applications Engineer | mfinn@mazakcorp.com

What are we covering?

What is Multitasking?



Levels of Multitasking

- Level 5 – Hybrid Multitasking



- Level 4 – 5-Axis Contouring



- Level 3 – 5-Axis Positioning



- Level 2 – 3-Axis Lathe w/milling



- Level 1 – 2-Axis Lathe



Part Complexity



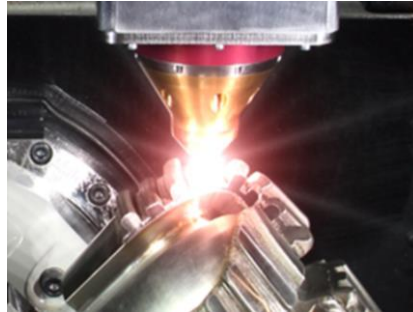
What is Hybrid Multitasking?



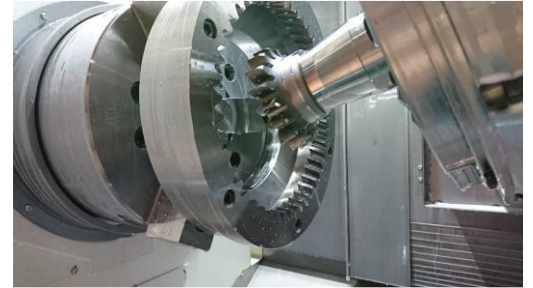
Traditional Machining (Subtractive) Processes
+



Friction Stir Weld



Additive Manufacturing

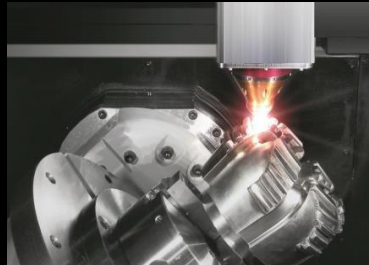


Gear Machining

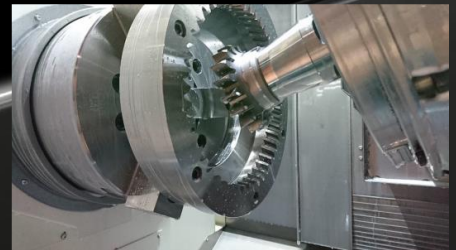
Let's Take a Look at Each of These Hybrid Processes



Friction Stir Weld

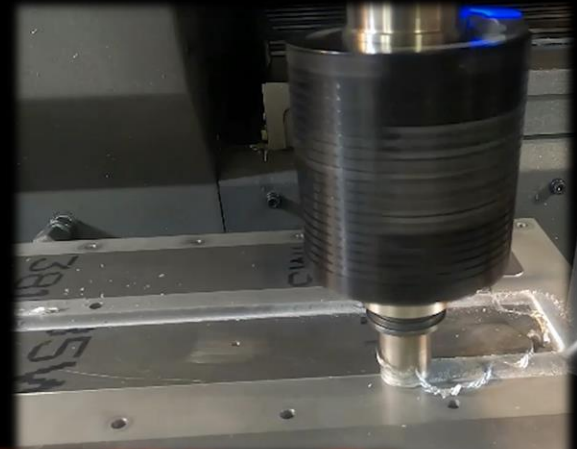
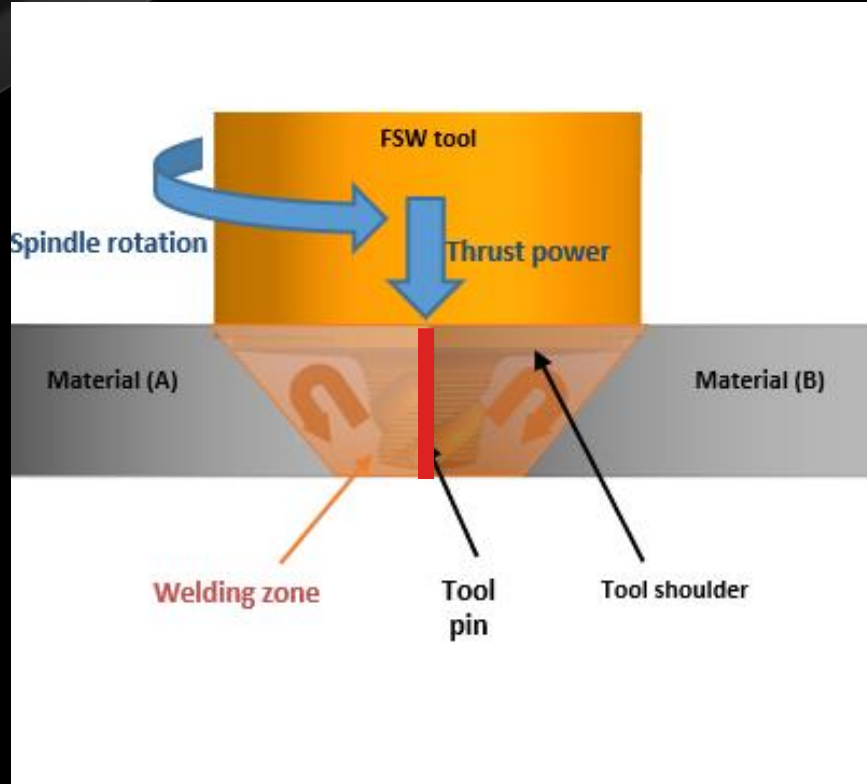


Additive Manufacturing



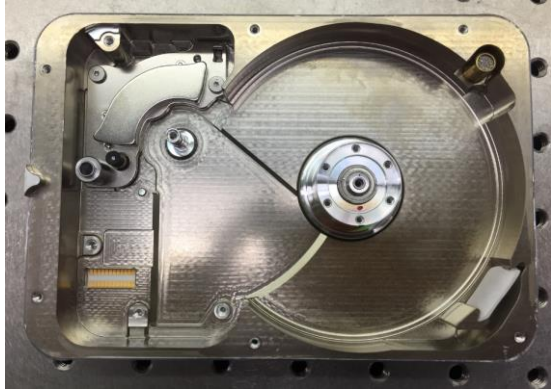
Gear Machining

Friction Stir Welding



Friction Stir Welding Part

Applications



TOP INDUSTRIES SERVED
BY FRICTION STIR WELDING

AEROSPACE

GROUND TRANSPORTATION

OIL & GAS

OCEAN TRANSPORT

TECHNOLOGY MANUFACTURING





Additional Machine Components for Friction Stir Welding

Machine Tool

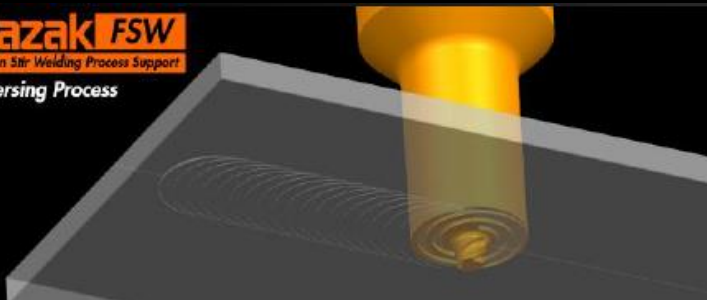


FSW Tooling

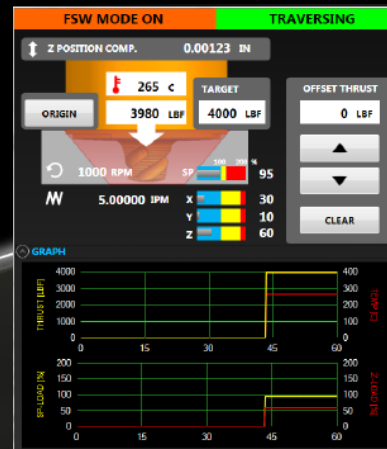


FSW Programming Cycles

Mazak FSW
Friction Stir Welding Process Support
Traversing Process



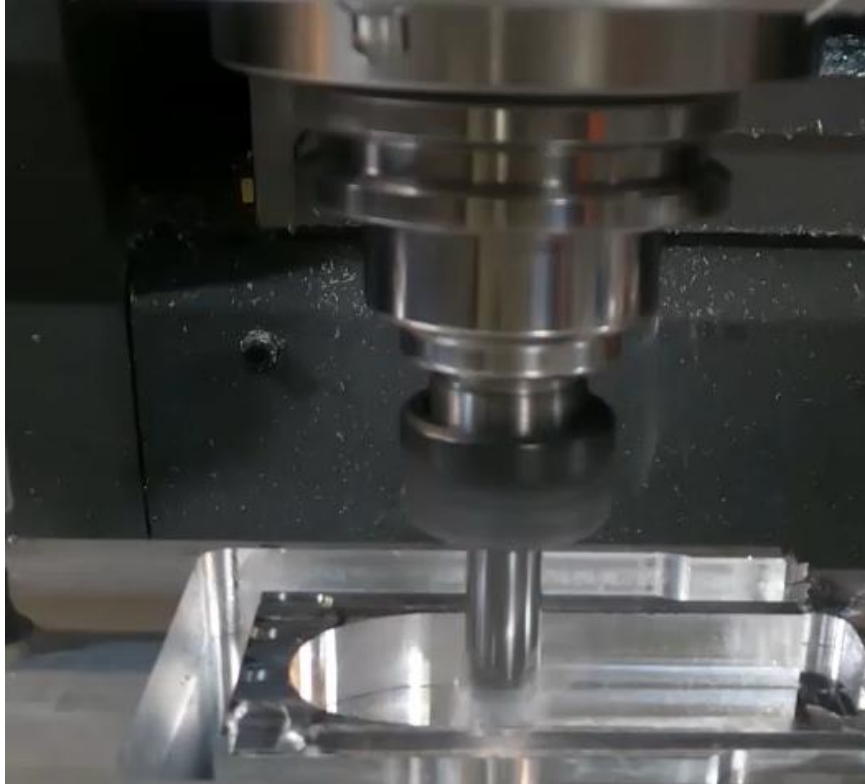
Closed Loop FSW Process Control



Typical Friction Stir Welding Hybrid Process Flow

Process Flow

Machine Mating Features
Subtractive



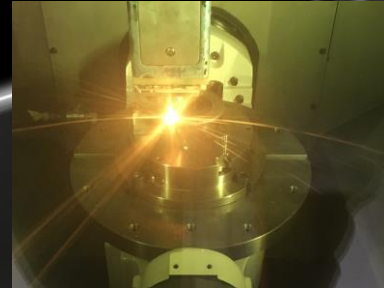
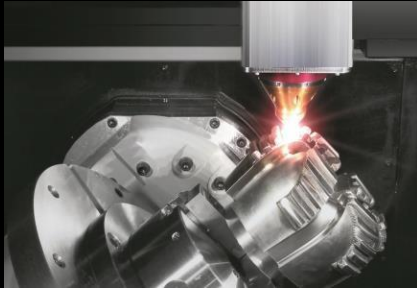
Assemble Then FSW Components Together
Solid state joining



Friction Stir Welding

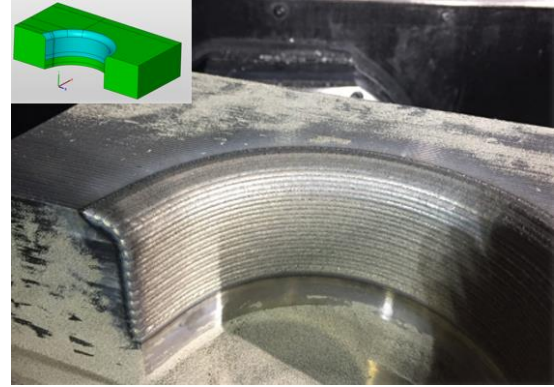


Additive Manufacturing



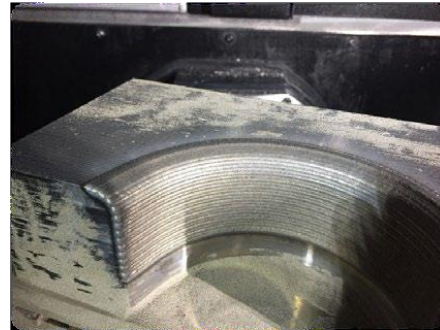
Component Repair

**Worn or damaged part surfaces
due to abrasion or corrosion**



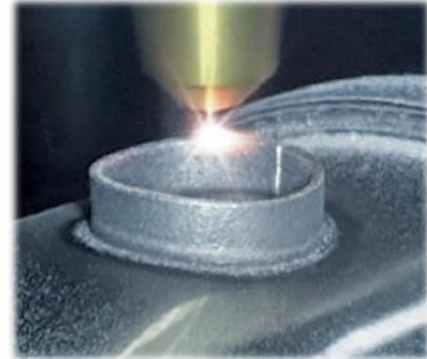
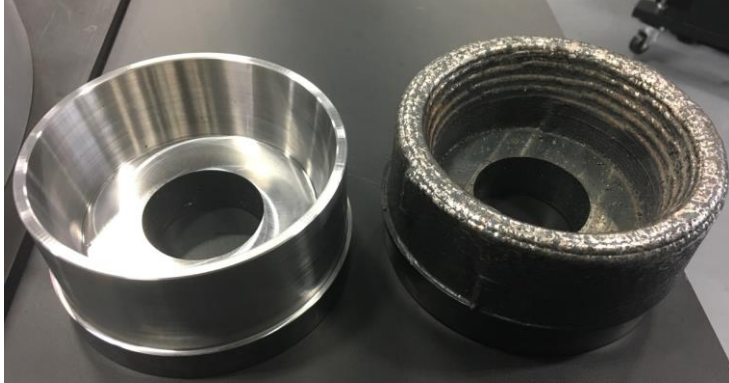
Cladding of Dissimilar Materials

Sealing Surfaces of dissimilar material to improve corrosive and wear properties



Rapid Prototype

Build freeform geometry and machine complete to quickly test component design performance

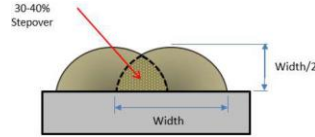


What Skill Sets and Tools are Required for AM?

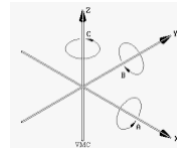
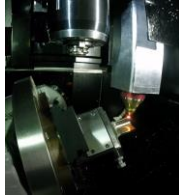
- CAD/CAM



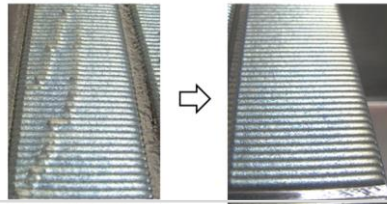
- Process Planning



- 5-axis

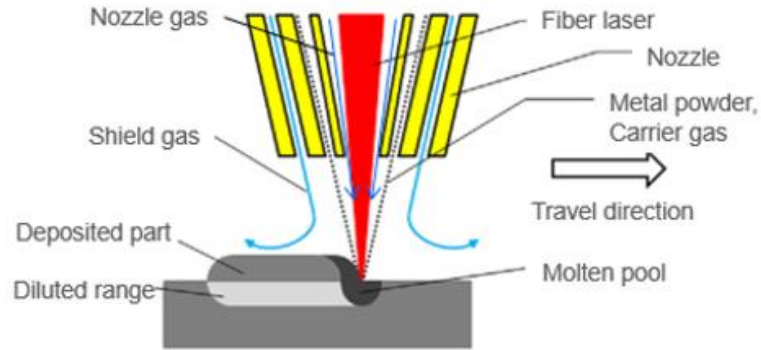


- Process Parameters

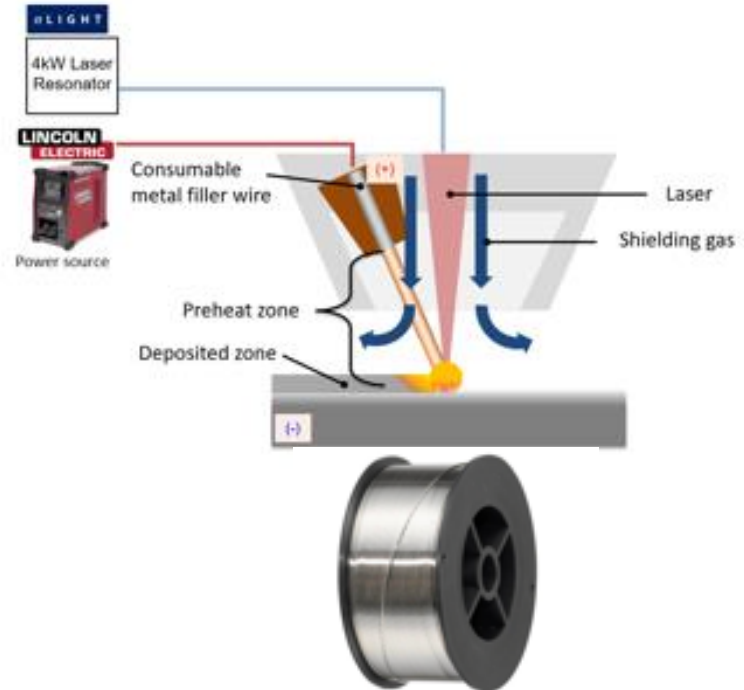


Additive Manufacturing Process

Laser Metal Deposition



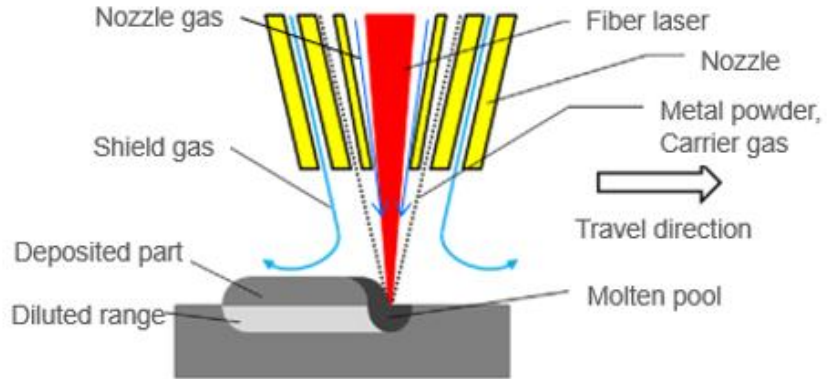
Hot Wire Deposition



Laser Metal Deposition (LMD)

Additive Manufacturing

Laser Metal Deposition



Additional Machine Components for LMD

Machine Tool



+

Fiber Optic Laser
Resonator



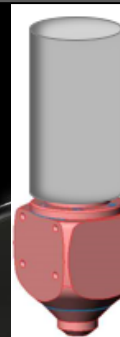
Chiller Unit



Powder Feeder



Additive Head



Shield Gas



Dust Collector



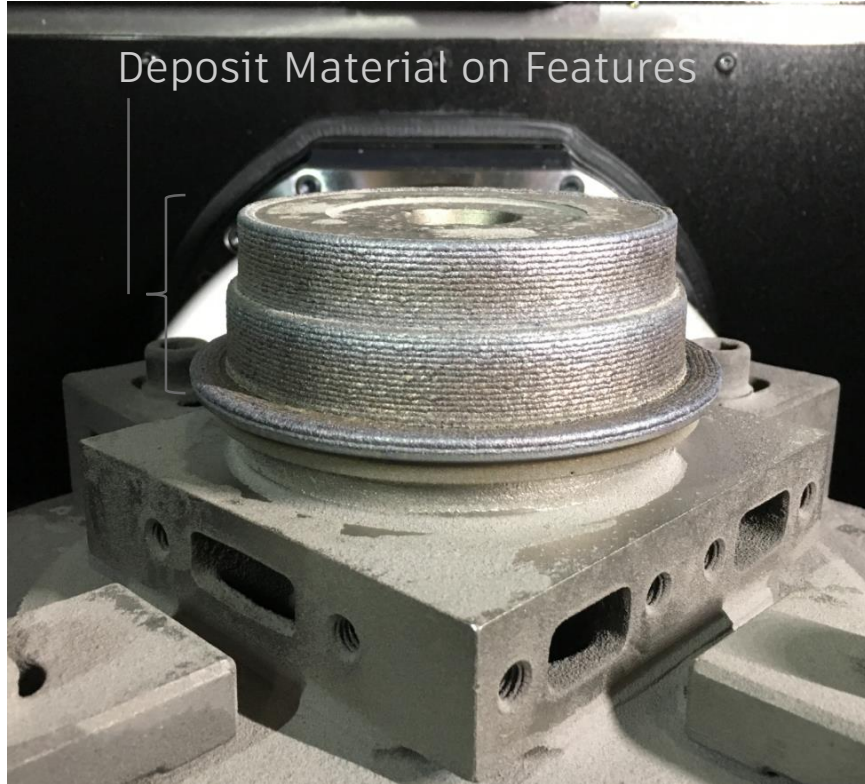
Powder Material



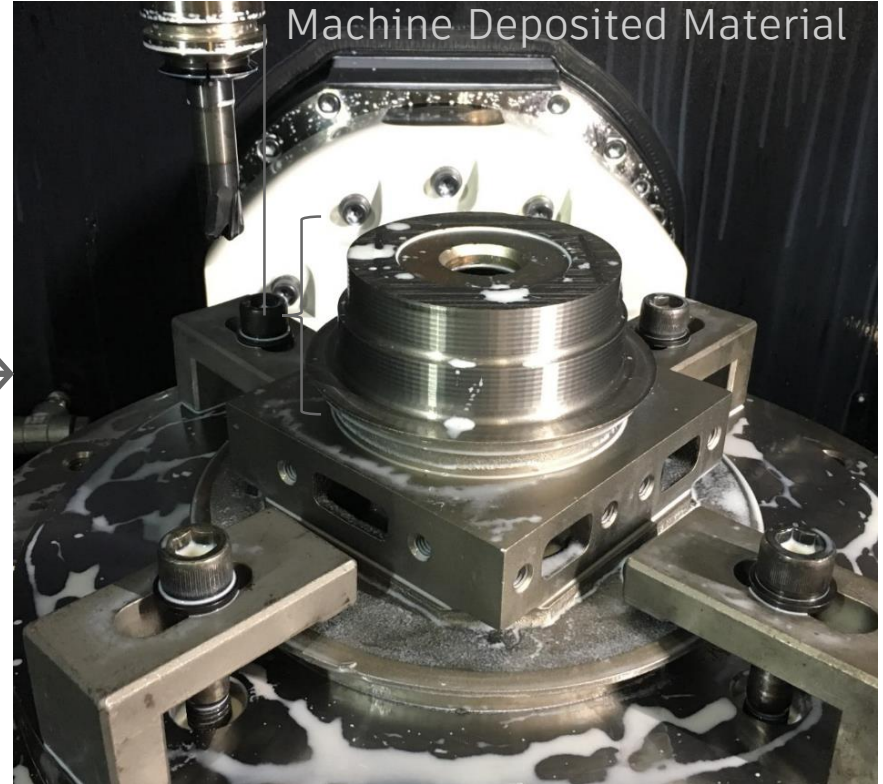
Typical LMD Hybrid Process Flow

Process Flow

Additive Operation

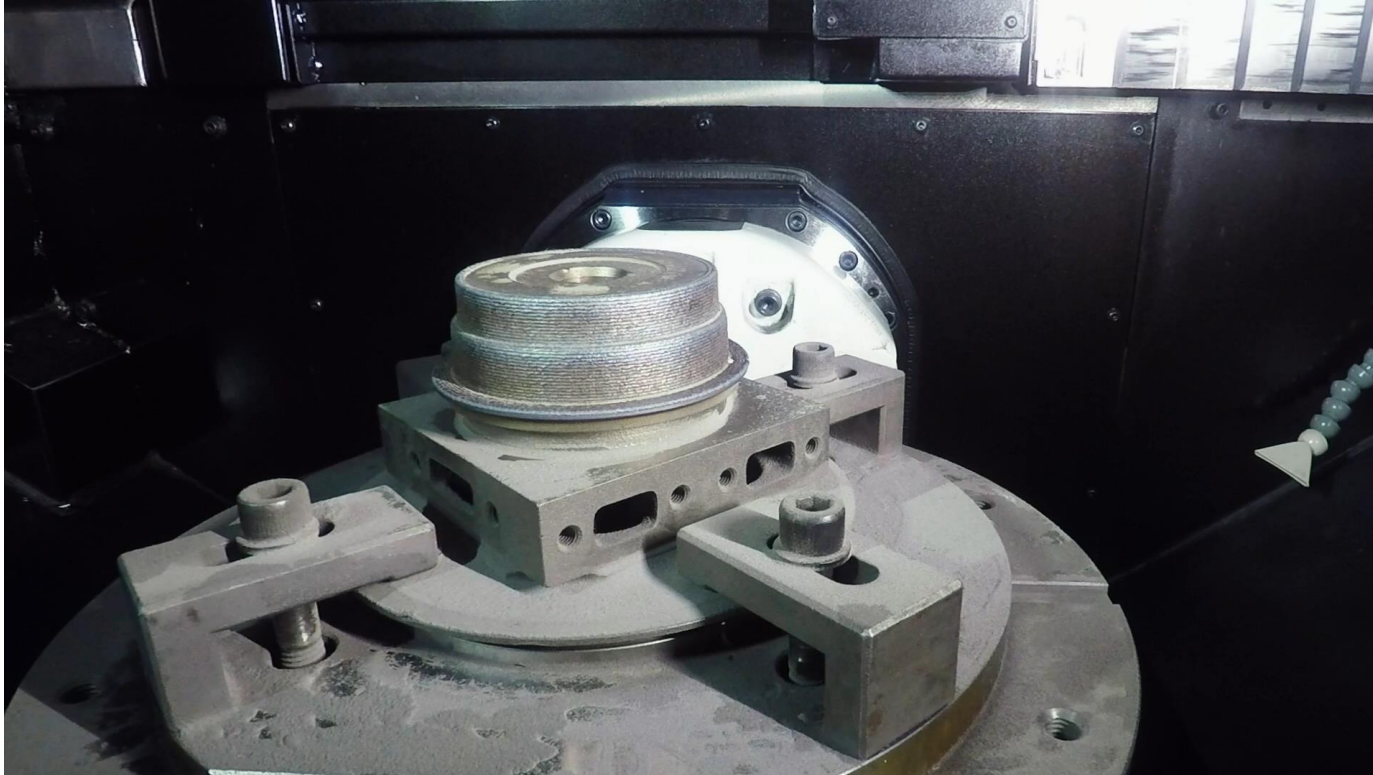


Machining Operation (Subtractive)



Repair Damaged Component

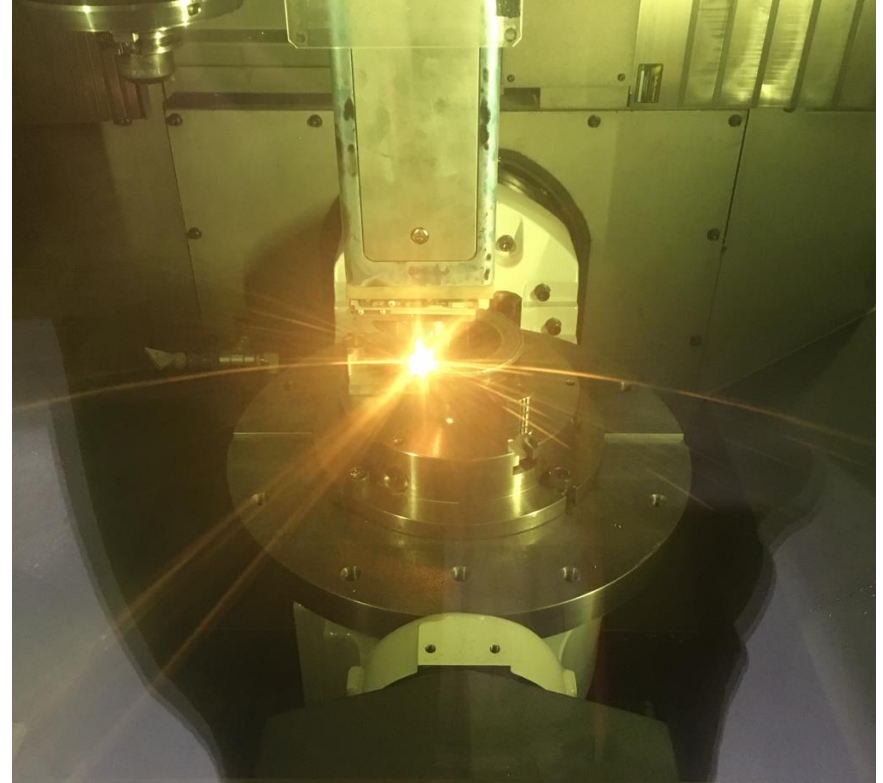
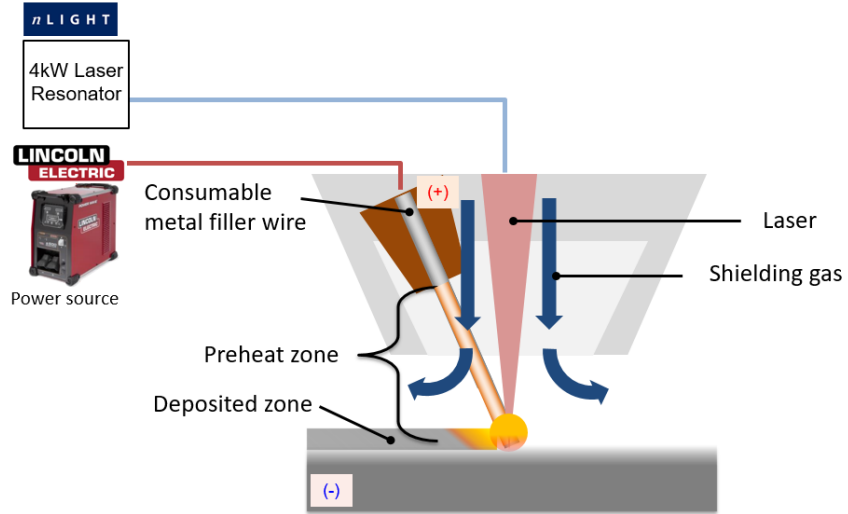
Adding material to damaged surfaces.



Hot Wire Deposition (HWD)

Additive Manufacturing

Hot Wire Deposition



Additional Machine Components for Hot Wire Deposition

Machine Tool



+

Fiber Optic Laser



Chiller Units



**Wire Pre-Heat
Power Source**



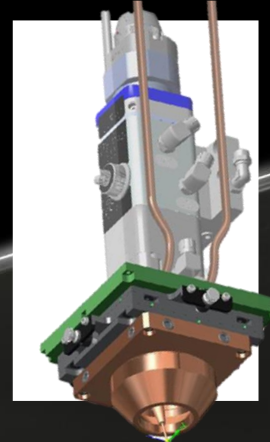
Wire Feeder



Shield Gas



Additive Head



Welding Wire



Typical Hot Wire Deposition Hybrid Process Flow

Process Flow

Additive Operation



Courtesy of:  **OAK RIDGE**
National Laboratory

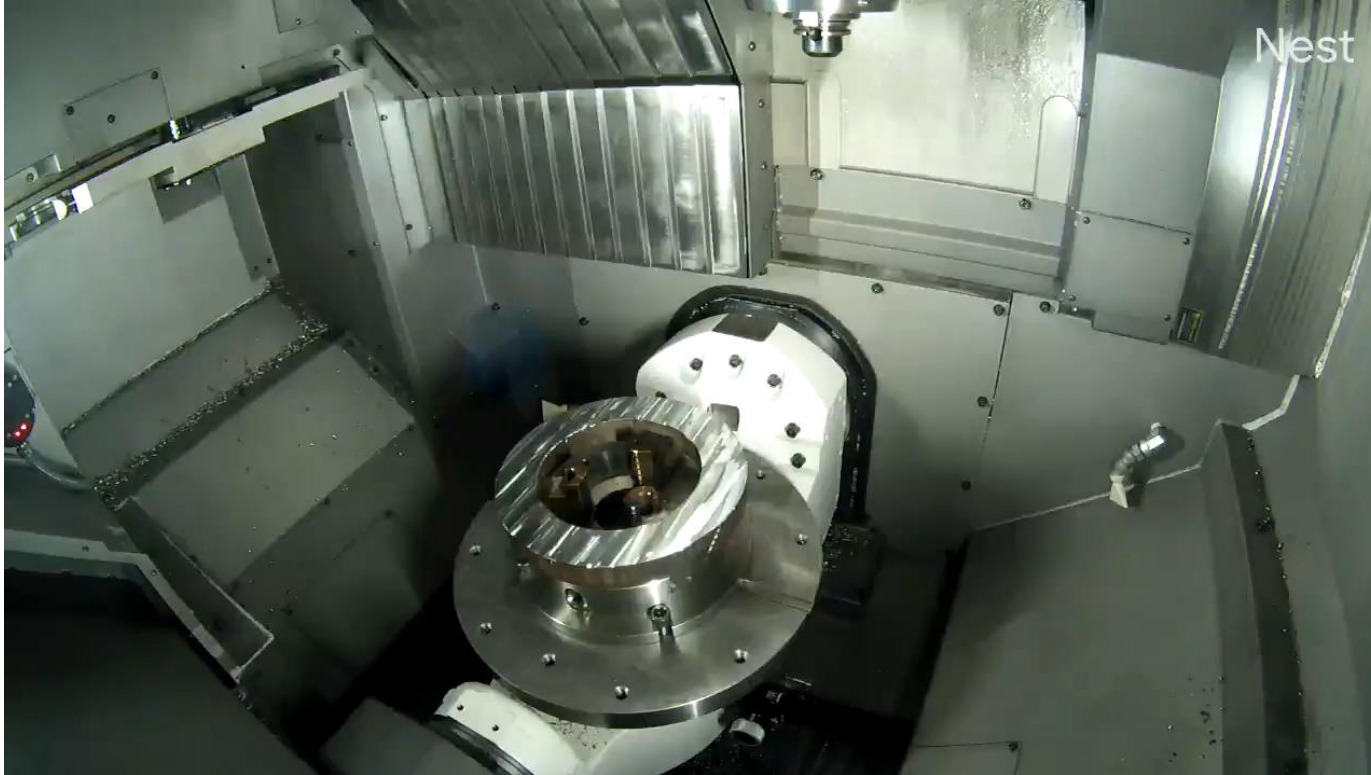
Machining Operation (Subtractive)



Build and Machine Complete

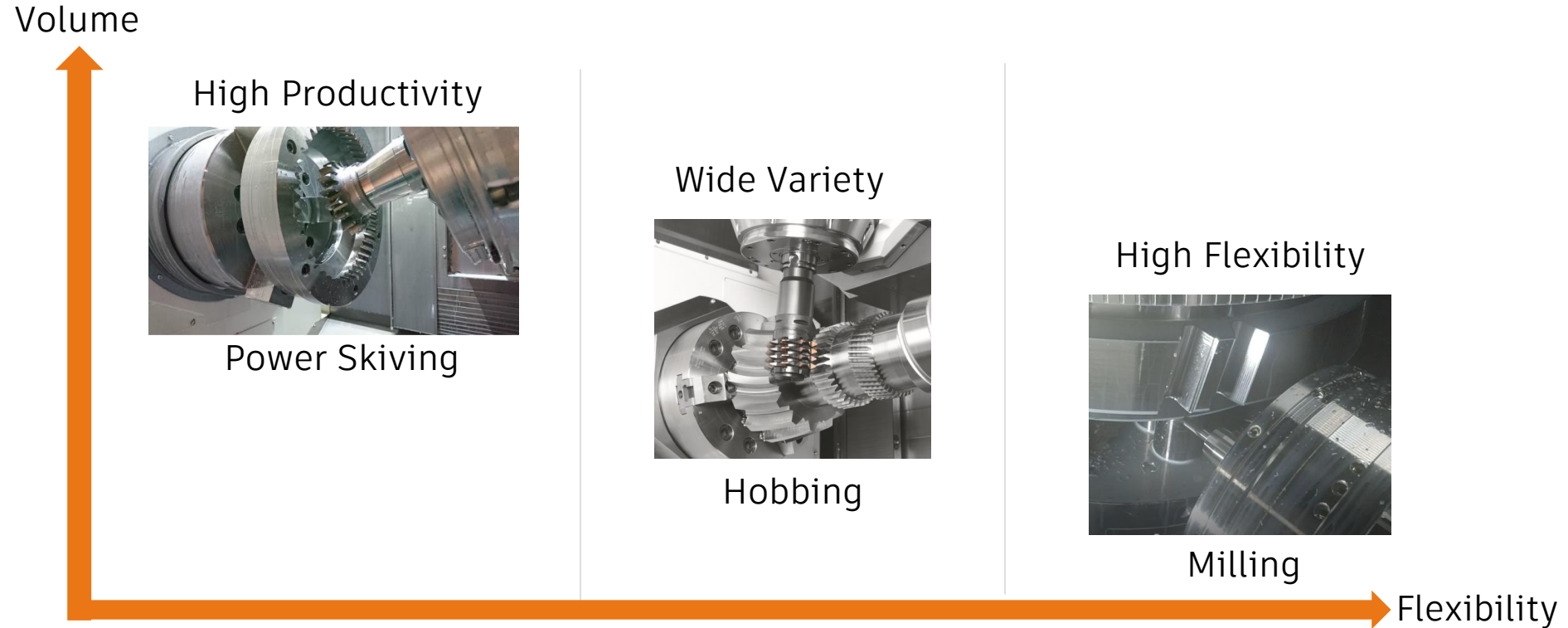
Adding material to substrate

Courtesy of:  **OAK RIDGE**
National Laboratory



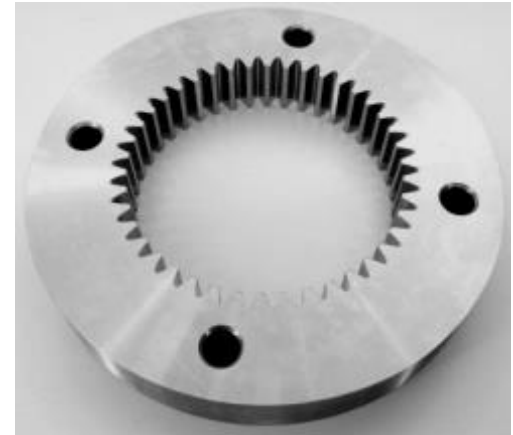
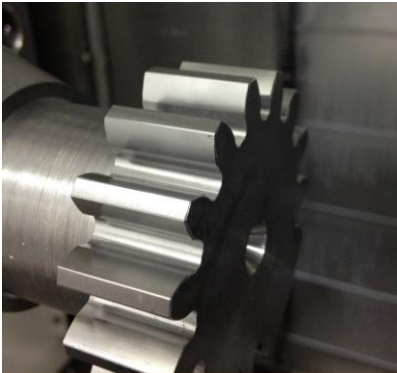
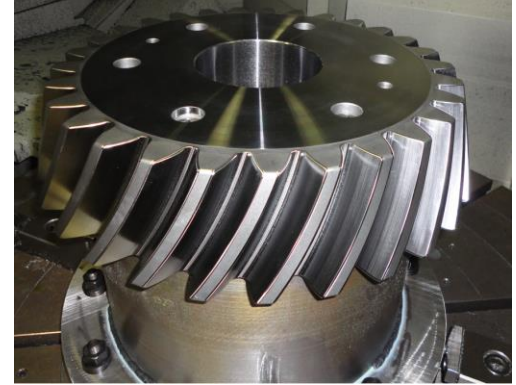
Gear Machining

Three Methods of Gear Machining



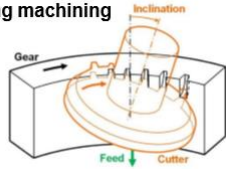
Common Gear Machining Parts

Applications



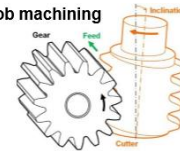
Spindle Synchronization

Skiving machining



Power Skiving

Hob machining



Hobbing

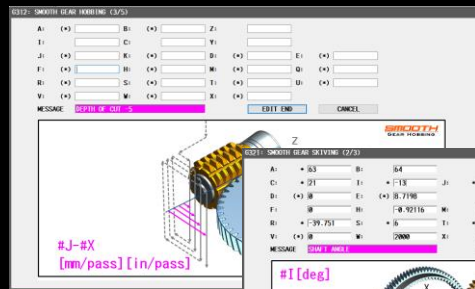


Additional Machine Components for Gear Machining

Machine Tool



On-Board Gear Machine Programming Software

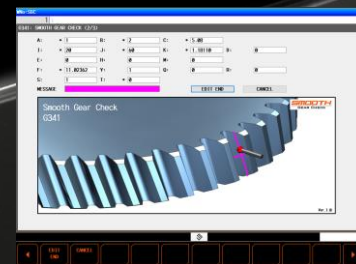
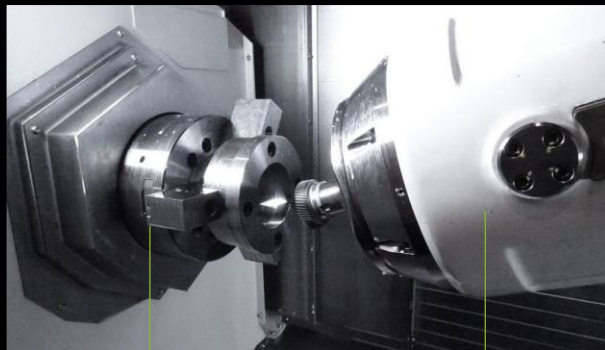


Hobbing

Power Skiving

Milling

Direct-Drive Spindles with Scale Feedback

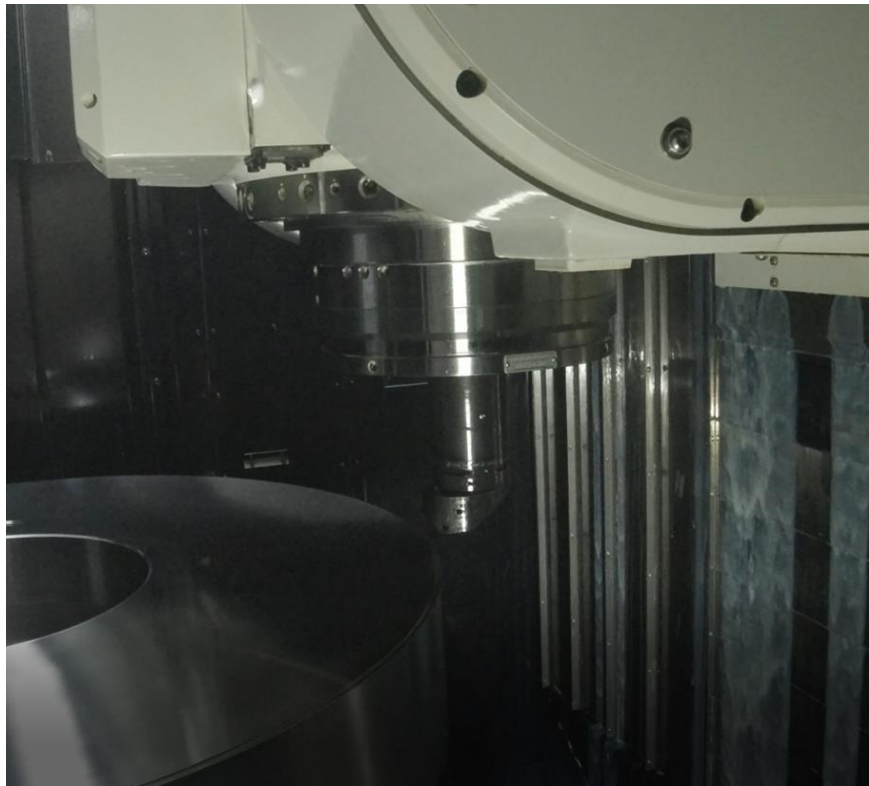


Gear Inspection

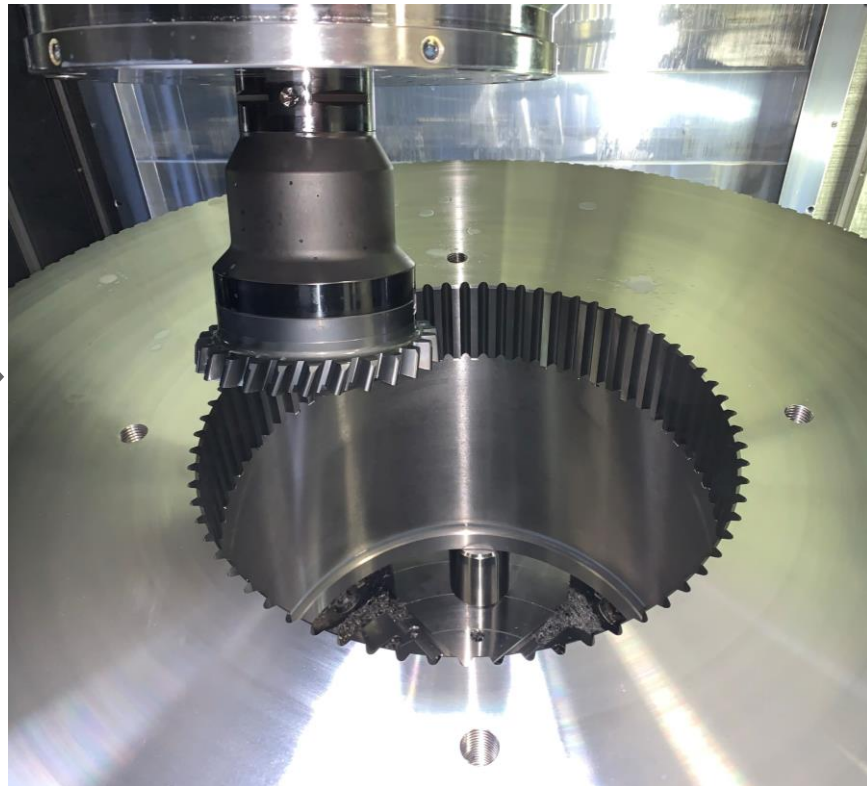
Typical Gear Machining Process Flow

Process Flow

Turn Features

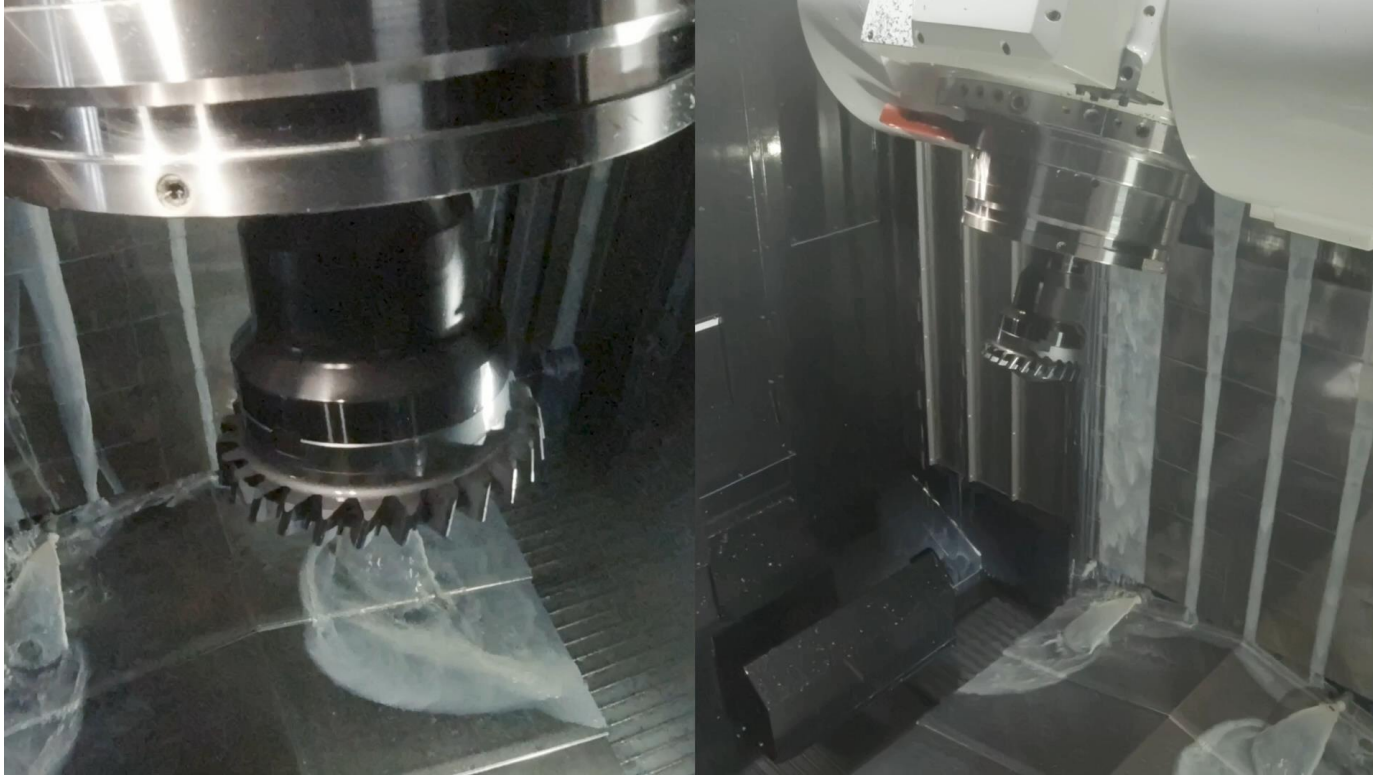


Machine Gear Teeth



Gear Machining

Power Skiving ID Spur Gear



Gear Machining

Gear Milling OD Helical Gear

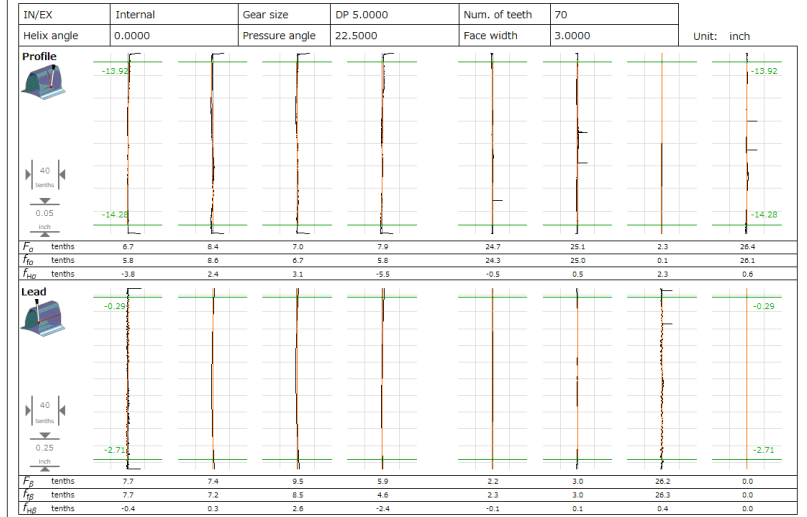


Gear Inspection

ID Gear Inspection using Scanning Probe

SMOOTH GEAR CHECK

Report 01/29/2021, 5:28:21 p.m.



Conclusion

- Hybrid Multitasking offers complete part processing of workpieces
- Combining Subtractive with Additive
- Producing seamless workflow
- Reduced Part Handling
- Improved Component Quality

The background is a dark, abstract composition of geometric shapes. It features several sharp, angular planes in shades of black and dark grey. Two prominent, bright, glowing lines run diagonally across the frame, one from the top-left towards the center and another from the top-right towards the center, creating a sense of depth and movement. The overall aesthetic is modern and high-tech.

Thank you!

The background features four abstract, dark, metallic-looking geometric shapes in the corners, resembling stylized computer monitors or architectural elements. They are arranged symmetrically, with two in the top corners and two in the bottom corners, creating a frame for the central text.

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