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Process Chain for Hybrid Manufacturing and Repair of Metal Components

The integration of additive manufacturing (AM) and subtractive machining techniques, supported by digital data management and simulations, forms the process chain for hybrid manufacturing and repair of metal components. This approach facilitates the efficient restoration of damaged parts and the production of complex geometries with enhanced mechanical properties within a digitalized industry. Laser-based directed energy deposition (DED) is employed for material addition, complemented by machining steps for preparation and surface finishing in a digital workflow. This integrated approach supports process design, machining set-ups, toolpath planning, as well as geometric analysis of damaged component areas, resulting in high-quality, functional components. Moreover, pre- or post-treatment processes such as sandblasting, heat treatment, or forming can be seamlessly included in the process chain. The hybrid process chain and the ability to integrate most of the process steps into a single machine offers a viable solution for transforming conventional process lines, creating new components and structures, and extending the life cycles of critical metal components across various.

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