



Skandinaviens nordligaste tekniska universitet  
Forskning & utbildning i världsklass

Starka forsknings- och innovationsområden vid LTU

# SMARTA MASKINER OCH MATERIAL

Additive  
Manufacturing  
(3D-Printing)



# ***Additive Manufacturing (3D-Printing)*** **as example theme** **for *Smart Machines and Materials***

- We have chosen *Additive Manufacturing*, also termed *3D-Printing*, as a very suitable theme to *demonstrate the possibilities for smart machines and materials*.
- AM enables *smart materials and machines*.
- *Smart AM-systems* can be invented.
- LTU has manifold relevant competence.



# This is Additive Manufacturing

- Free from the limitations of conventional manufacturing technologies
- Go from a CAD geometric design to the finished component in much shorter time
- Design beyond your imagination
- Reduce the outlay on the high-value material



# Why is Smart Machines, Materials and Processes + Additive Manufacturing = TRUE

**Prototyping**, design testing, early elimination of design flaws, fit and assembly trials, functional prototypes

**Lightweight construction**, internal grid structures, hollow structures, bionic structures



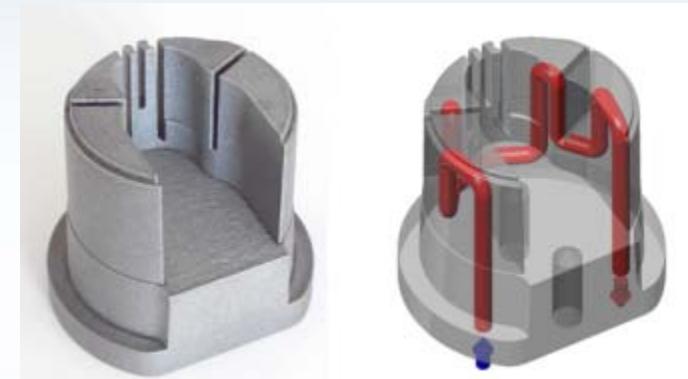
*Fraunhofer IWS Dresden*



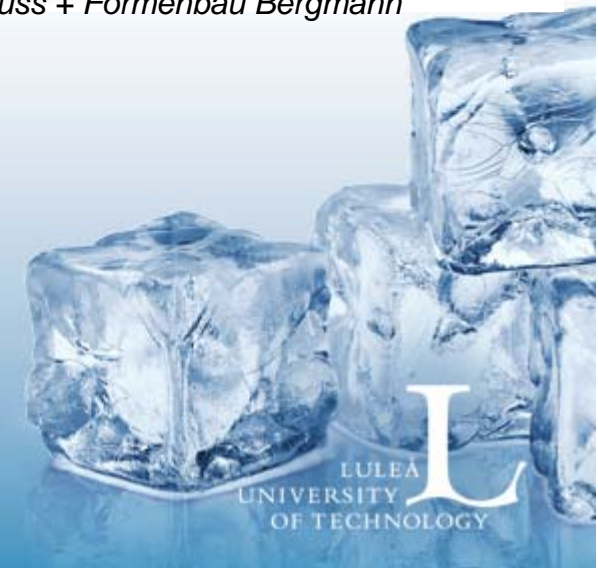
# Why is Smart Machines, Materials and Processes + Metal Additive Manufacturing = TRUE

**Tooling**, internal cooling channels (conformal cooling), temperature control, modular tooling

**Production**, small and medium scale series production, production of spare parts, production of high complexity components

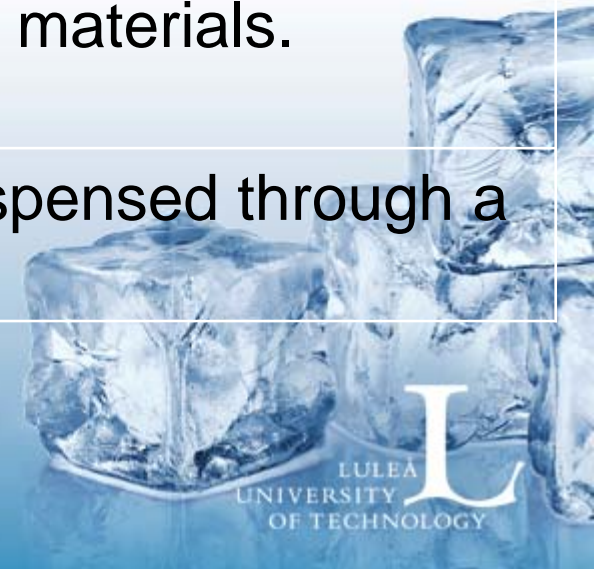


*Spritzguss + Formenbau Bergmann*



# Additive Manufacturing: Some techniques

Powder Bed Fusion	Thermal energy (laser, electron beam) selectively fuses regions of a powder bed.
Directed Energy Deposition	Focused thermal energy (laser, electron beam, plasma) is used to fuse materials by melting as they are being deposited.
Binder Jetting	A liquid bonding agent is selectively deposited to join powder materials.
Material Extrusion	Material is selectively dispensed through a nozzle or orifice.



# Additive Manufacturing: Some techniques

Powder Bed  
Fusion

SLS, Selective Laser Sintering  
SLM, Selective Laser Melting,  
Electron Beam Melting.....

Directed Energy  
Deposition

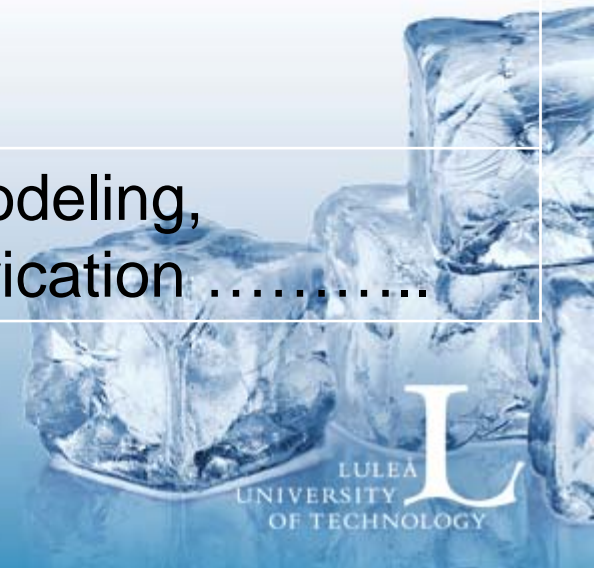
LMD, Laser Melting Deposition  
...

Binder Jetting

Digital Metal  
...

Material Extrusion

Fused Deposition Modeling,  
Fused Filament Fabrication .....





# Additive Manufacturing is used in ...

- Aerospace
- Industrial applications
- Dental/medical
- Fashion design



*EOS*







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