

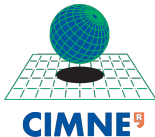
LARGE SCALE SIMULATION OF ADDITIVE MANUFACTURING

An introduction.

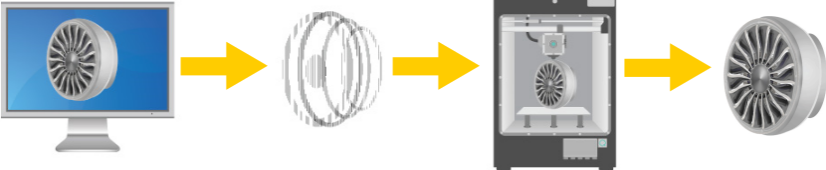
Eric Neiva

Advisors: Michele Chiumenti & Santiago Badia

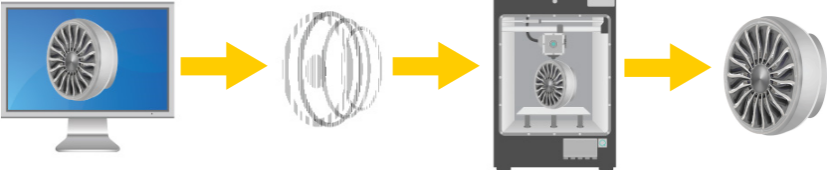
November 10, 2015



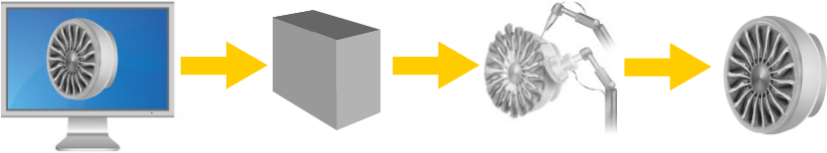
Additive Manufacturing = 3D Printing



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...as opposed to Subtractive Manufacturing



Adapted from Deloitte University Press

AM will supplement conventional production methods, not replace them.

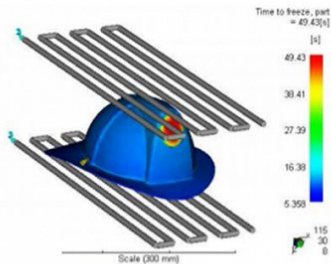
- Customized items



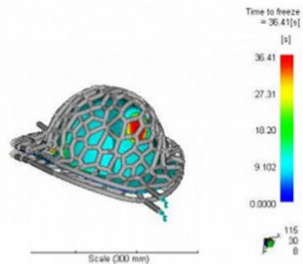
Source: EOS

AM will supplement conventional production methods, not replace them.

- Small batches



(a) Conventional channel design



(b) Channels generated by our approach

Source: CAxMan

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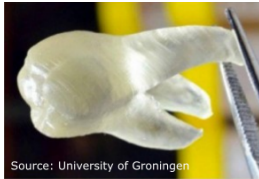
- Complex geometries



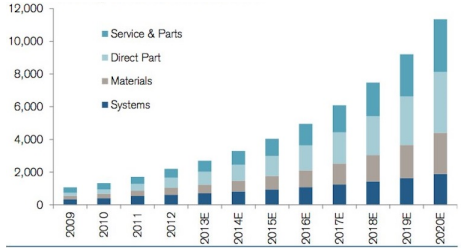
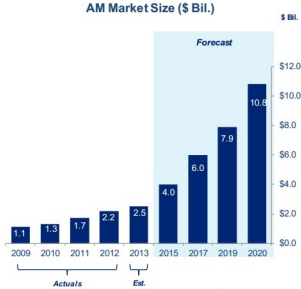
Source: SAVING Project

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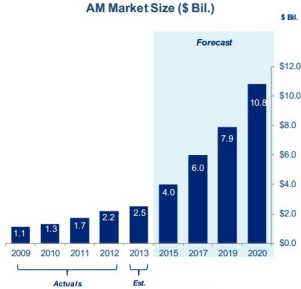
- Widespread impact



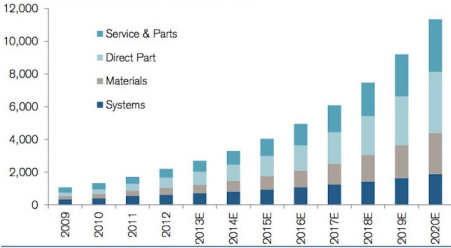
AM market will double in 3-4 years...



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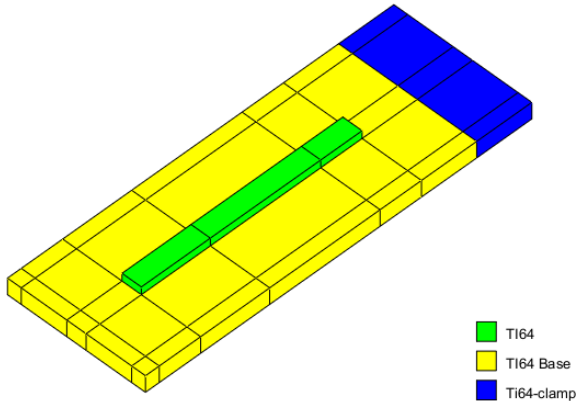
Source: Wohlers Associates, May 2013;



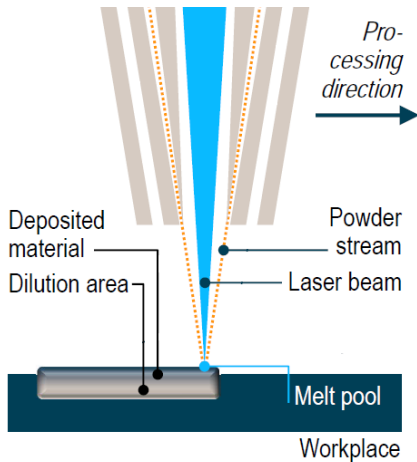
Source: Credit Suisse estimates.

...but Computer-aided Technologies (s.a. FEA) are still in development!

The target technology of this work is AM by blown powder for metals



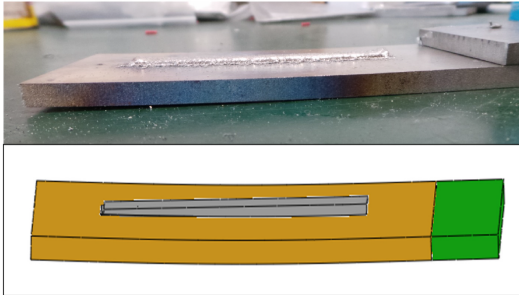
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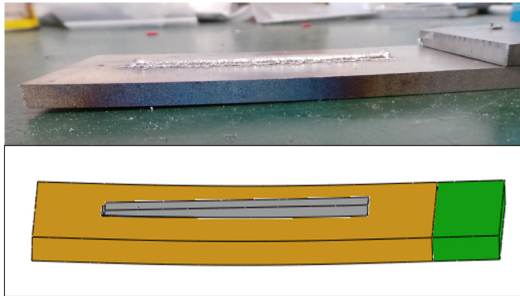
Source: Roland Berger

The target technology of this work is
AM by blown powder for metals

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Global response?

T° distribution \rightarrow Residual σ + Distortions

An accurate numerical simulation is challenging...

1. Transient & nonlinear coupled thermo-mechanical problem:
local thermal loading → **global mechanical response**

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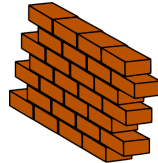
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local thermal loading → **global mechanical response**
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...because the computational cost is very high!



GOAL of this Master Thesis: efficient technique for the numerical simulation

2 ideas

1. Simplification

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1. Simplification
2. High performance computing

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 - 2.2 Nonlinearities?

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Acknowledgements: Financial support from the *CAxMan Project* (Project Reference 680448) funded under the *Horizon 2020* EU Framework Programme (H2020-EU.2.1.1., H2020-EU.2.1.5., H2020-EU.2.1.5.1.) is gratefully acknowledged.