

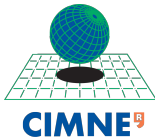
LARGE SCALE SIMULATION OF ADDITIVE MANUFACTURING

An introduction.

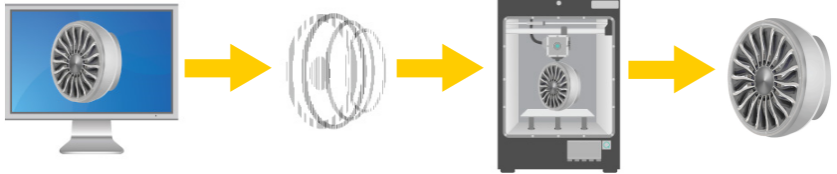
Eric Neiva

Advisors: Michele Chiumenti & Santiago Badia

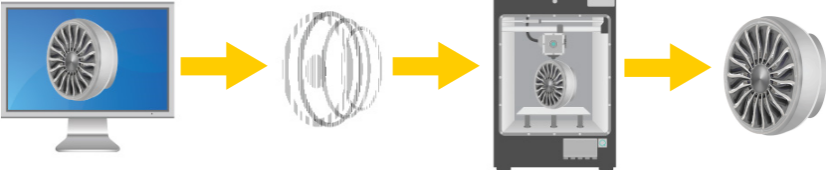
November 11, 2015



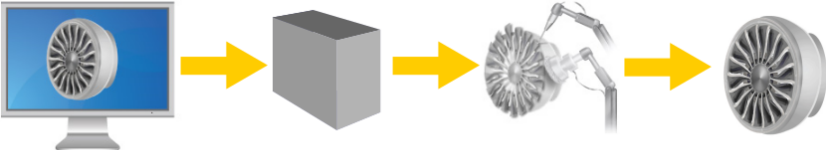
Additive Manufacturing = 3D Printing



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...as opposed to Subtractive Manufacturing



Adapted from Deloitte University Press

AM will supplement conventional production methods, not replace them.

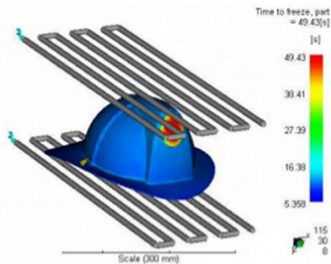
- Customized items



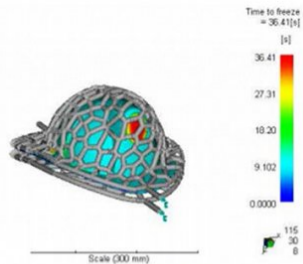
Source: EOS

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- Small batches



(a) Conventional channel design



(b) Channels generated by our approach

Source: CAxMan

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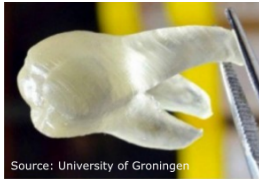
- Complex geometries



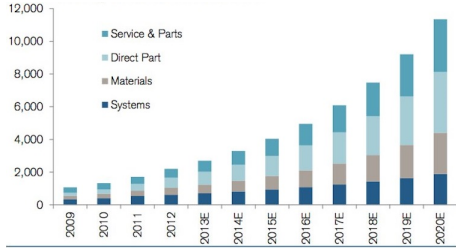
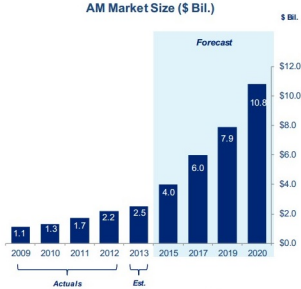
Source: SAVING Project

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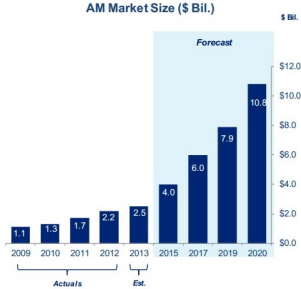
- Widespread impact



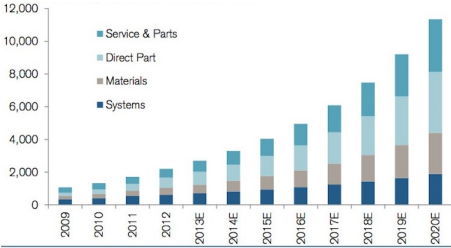
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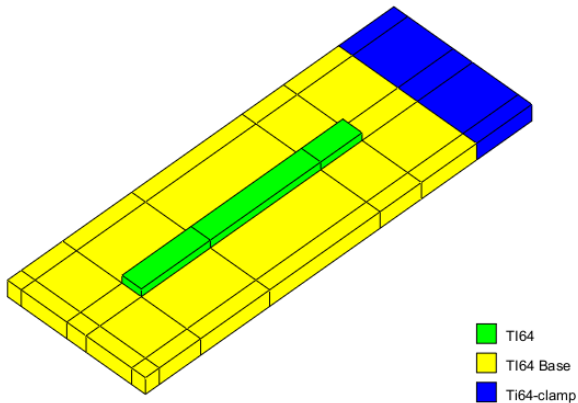
Source: Wohlers Associates, May 2013;



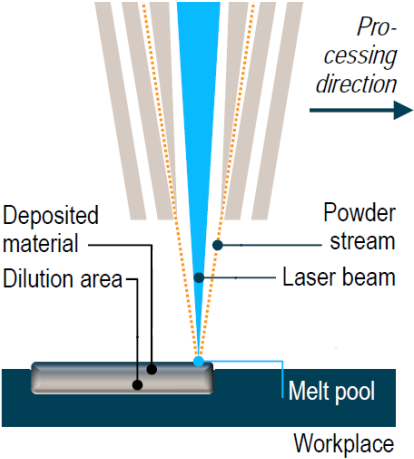
Source: Credit Suisse estimates.

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

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



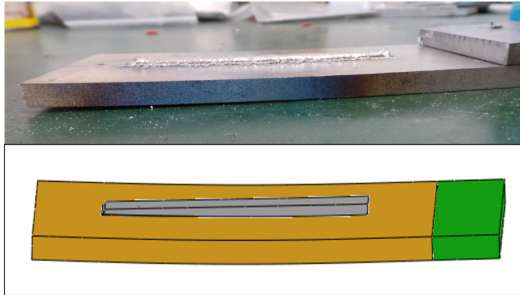
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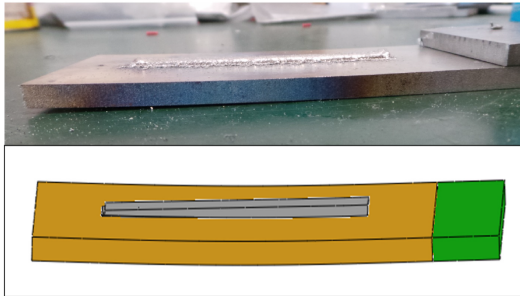
Source: Roland Berger

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AM by blown powder for metals

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Global response?

T° distribution \rightarrow Residual σ + Distortions

An accurate numerical simulation is challenging...

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local thermal loading → **global mechanical response**

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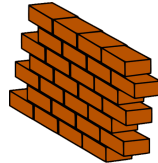
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...because the computational cost is very high!



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

- ▶ From Chiumenti et al. (2015):
 - ▶ High-fidelity numerical simulation + Sensitivity analysis ✓

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Reference: M. Chiumenti, X. Lin, M. Cervera, W. Lei, Y. Zheng and W. Huang. "Numerical simulation and experimental calibration of Additive Manufacturing by blown powder technology. Part I: thermal analysis" (2015) Submitted to Rapid Prototyping Journal.

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