Integrated Design of Material, Manufacturing and Product Performance

Ideo_M²P²



Statement

Computational methods for **Concurrent design of material, manufacturing process and product** is a key factor for competitiveness and sustainability in 21st century.

Dave McDowell



Strategic relevance

- The competiveness of Swedish companies consists mainly in competence. The knowledge to design and produce products, services etc that are 'needed'.
- We have been and still are in many areas world leading. However, above is not a unique Swedish strategy and the competition is fierce.
- There are still opportunities for the classical mechanical industry to go one step further.

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Key ingredients:

- Models based engineering design.
- Creating a larger design space enabling disruptive engineering solutions.
- Transforming engineering design by merging materials, process and product design. Eliminating its dichotomy into materials science, production and mechanics as well as restructuring engineering education.
- Business role between material user and producer will change.



State of Art and Ideo_M²P²

Related strands in US





Ideo_IM²P²

Simultaneous and hierarchical design of Performance Product Manufacturing process Material properties Geometric distribution of properties¹ Material microgeometry² Microstructure Design of initial chemical composition

Bottom

Top

¹reinforcements, surface layers or barriers ²powders size distribution, granular materials



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Paradigm Shifts in Engineering Methods

- Merger of Material, Production and Design
- Science and Model Based Engineering
- Use of manufacturing for creating material properties rather than attempting to minimize its negative effects

Leading to improved (incremental and disruptive) materials, manufacturing processes products w.r.t.

- Performance including multifunctionality and
- Sustainability.



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Key modelling ingredients:

Thermodynamics Engineering Materials (mechanical, thermal, corrosive, electrical... Small scale(s) modeling and homogenization Virtual material testing Macroscopic material models Process models Product models



