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SYSTEMATIC STRUCTURING OF DESIGN KNOWLEDGE

A combined research approach to improve design processes by optimal structuring of knowledge.

CHALLENGES

Nowadays, complex product development processes face the challenge of including novel technologies and require new understanding of phenomena. New product knowledge requires accurate prediction of product behavior based on the fundamental laws of physics (step 1): **from fundamental principles to analysis methods.**

The next step is to integrate this new knowledge into the existing design processes (step 2): **from analysis methods to design processes.**

Finally, the design activities on multiple levels of abstraction require an efficient strategy to result in development processes that are both faster and better than the competition (step 3): **from design processes to design strategies.**

step 3

step 2

step 1

LEVEL	MODEL	RESEARCH
Design Strategy	<pre> graph TD conceptual --> parametric conceptual --> shape parametric --> shape </pre>	Systematic execution of design process models
Design Process	<pre> graph TD requirements --> Synthesis Synthesis --> design_parameters[design parameters] design_parameters --> Analysis scenario --> Analysis Analysis --> actual_performance[actual performance] actual_performance --> Evaluation Evaluation --> solution Evaluation -- 1 --> Modification Modification --> Synthesis </pre>	Systematic creation of design process models
Analysis Method	<pre> graph TD design_parameters --> Analysis scenario --> Analysis Analysis --> actual_performance </pre>	Systematic creation of analysis knowledge/methods
Principles / Phenomena	$\frac{d\hat{\rho}}{dt} = -\frac{i}{\hbar}[\hat{H}, \hat{\rho}] - \frac{\gamma}{2}[\hat{q}, [\hat{q}, \hat{\rho}]] + \sqrt{\gamma}W\{\hat{q} - \langle \hat{q} \rangle, \hat{\rho}\}$ $\bar{q} = \langle \hat{q} \rangle + \frac{1}{2\sqrt{\gamma}}W$	