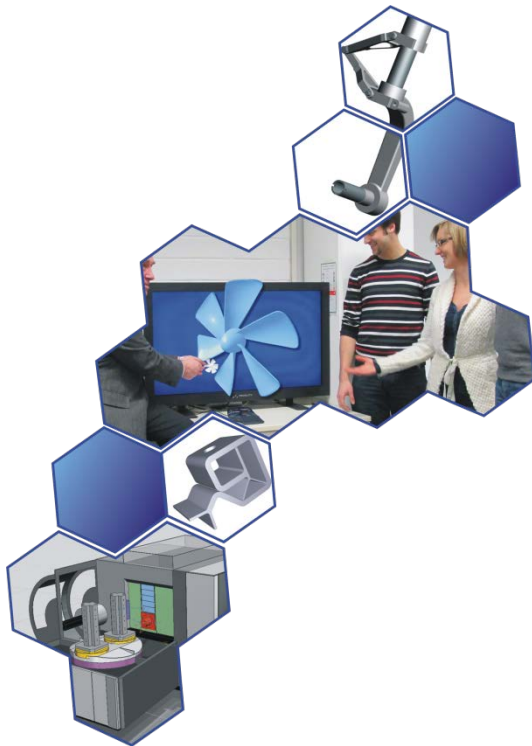


Smart Product and Production Engineering enabling new Business Models



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- 1. Introduction**
- 2. Approaches to Smart Product and Production Engineering**
- 3. Physical and Digital Demonstrator of CRC 805**
- 4. Impact on new Business Models**
- 5. Conclusions**





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The Dream was born



Prof. Kagermann (acatech) Prof. Wahlster (DFKI) Prof. Lukas (BMBF)

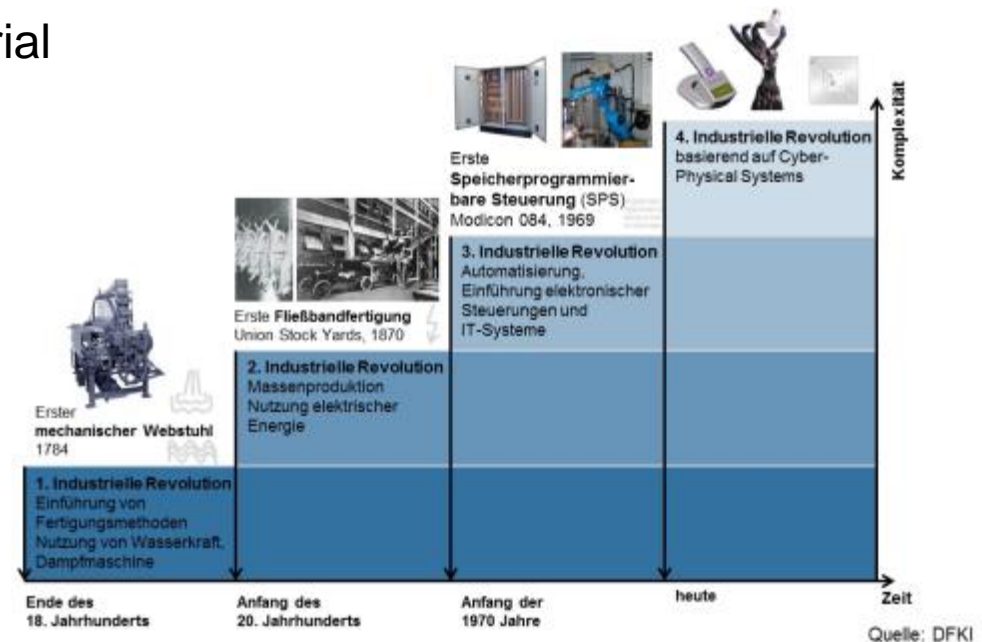
Industrie 4.0 – what does it mean?

The term Industrie 4.0 is a play on words consisting of 3 parts.

First “Industrie” indicates that this initiative is dedicated to industry.

Second, “.0” references the internet technology and intends to create the association with Web 1.0, Web 2.0, Web 3.0, Web ... technology.

Third, the “4” stands for the 4th industrial revolution and aims at reaching a new level of industrial value chains covering the whole product lifecycle.

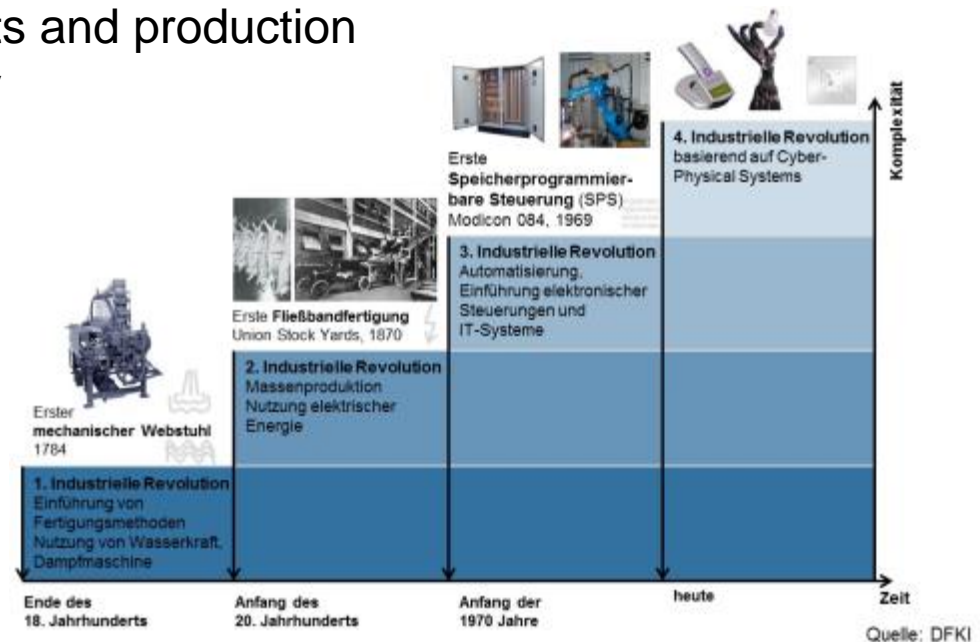


Industrie 4.0 – what does it mean?

Industrie 4.0 means the 4th industrial revolution and aims at new value chains covering the whole product lifecycle.

The technological approach is the use of so-called Cyber-Physical Systems, which comprise modern control systems containing embedded systems equipped with an internet address..

Applying this approach future products and production equipment are enabled to be logically interlinked and are able to communicate.





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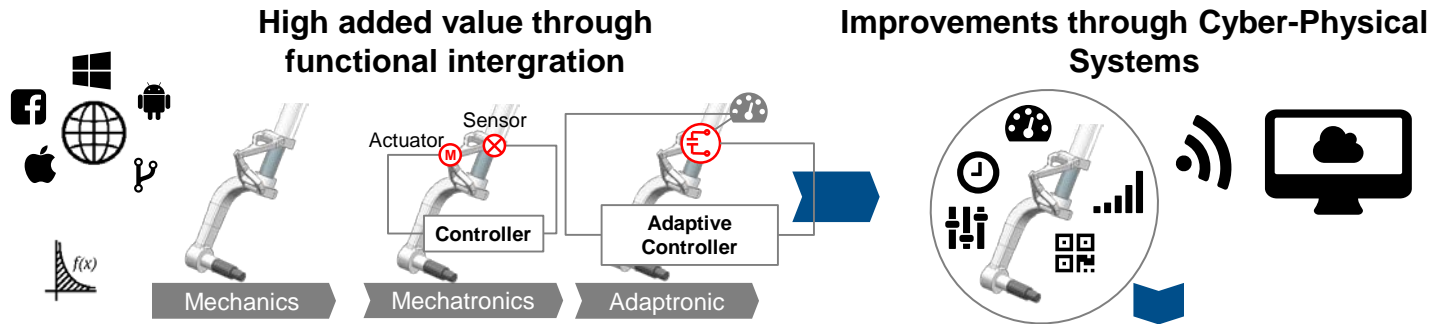
Approaches to Smart Product Engineering

New Internet Based Platforms & Ecosystems

Product Performance as a Service

Product- Service Systems

New Business Models?



Connected and communicating Systems



Cyber-Physical Systems supporting networking and communication

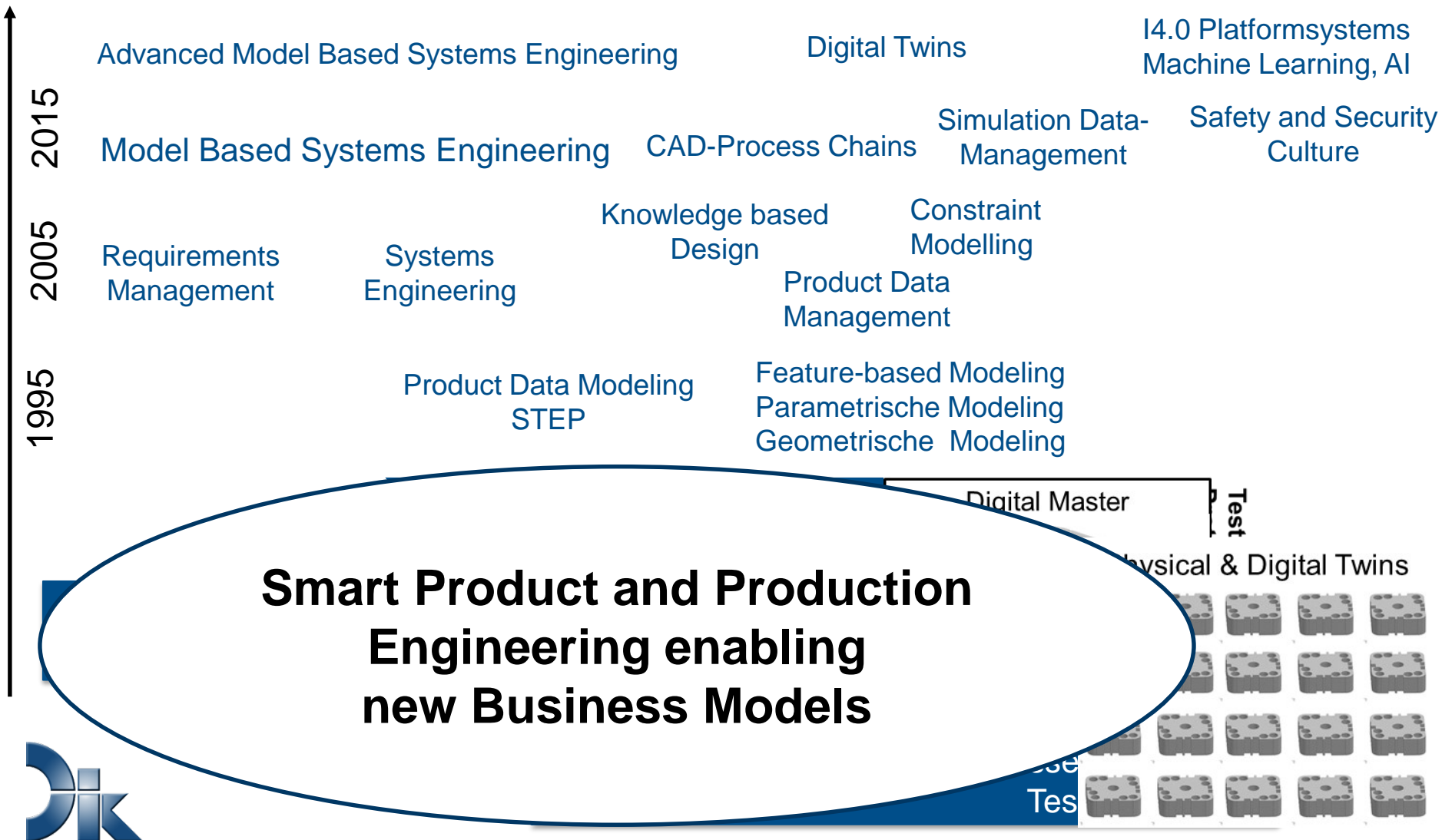
- Condition Monitoring
- Systems and Structural Health Monitoring
- Remote Diagnosis and Control
- Track and Trace



Model driven Digitalization of the Product Creation Process



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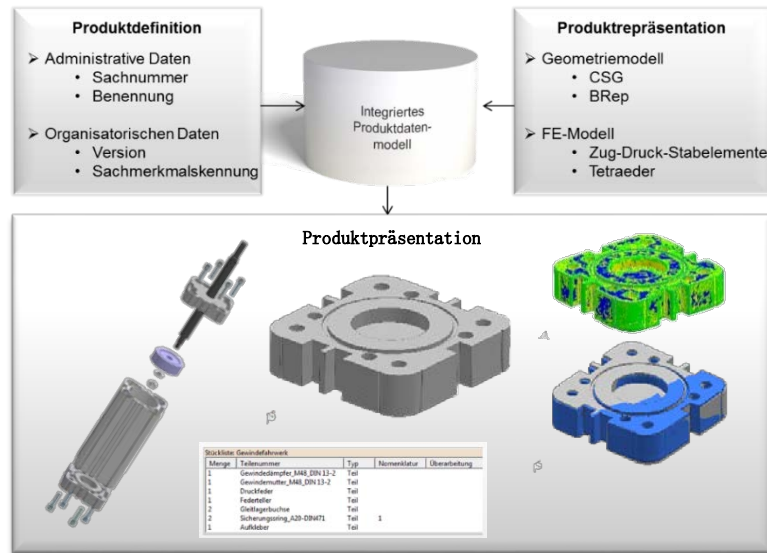


Industrie 4.0: Digital Master – Digital Twins

Digital Master...

... describes released product data used Throughout the product life cycle.

... should be available based on the International standardized (ISO 10303 „STEP“), to ensure seamless data integration



Digital Twins...

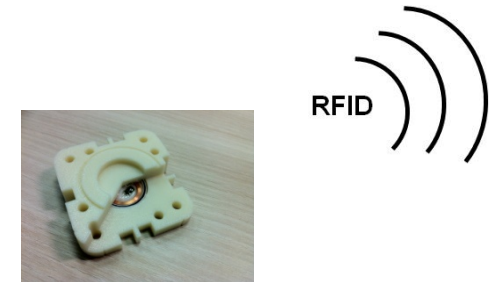
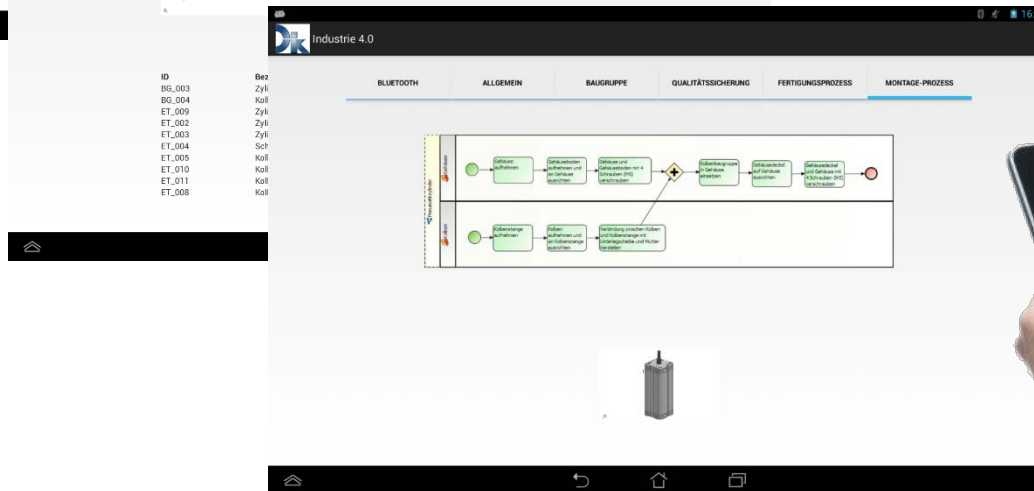
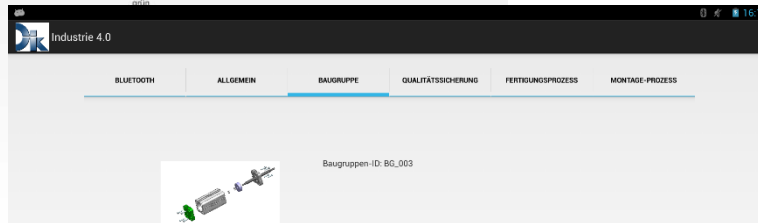
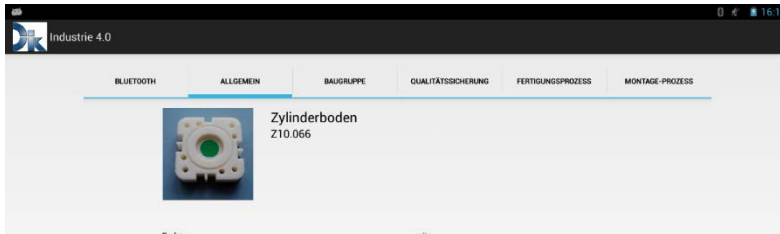
... describe a digital representation of physically existing components. Each Physical Twin is referenced to its Digital Twin.

... provides a fundamental approach for Industrie 4.0 because it represents structured information of individualized physically existing components. Ideally it also is represented based on ISO 10303.



Components are Information Carriers

Identification, Localisierung, Addressing, Connectivity, Communication



Smart Product and Production Engineering is an integrated approach for a Business Model driven development of Smart Products und Smart Production Systems.

Smart Product and Production Engineering aims at new methods and tools for

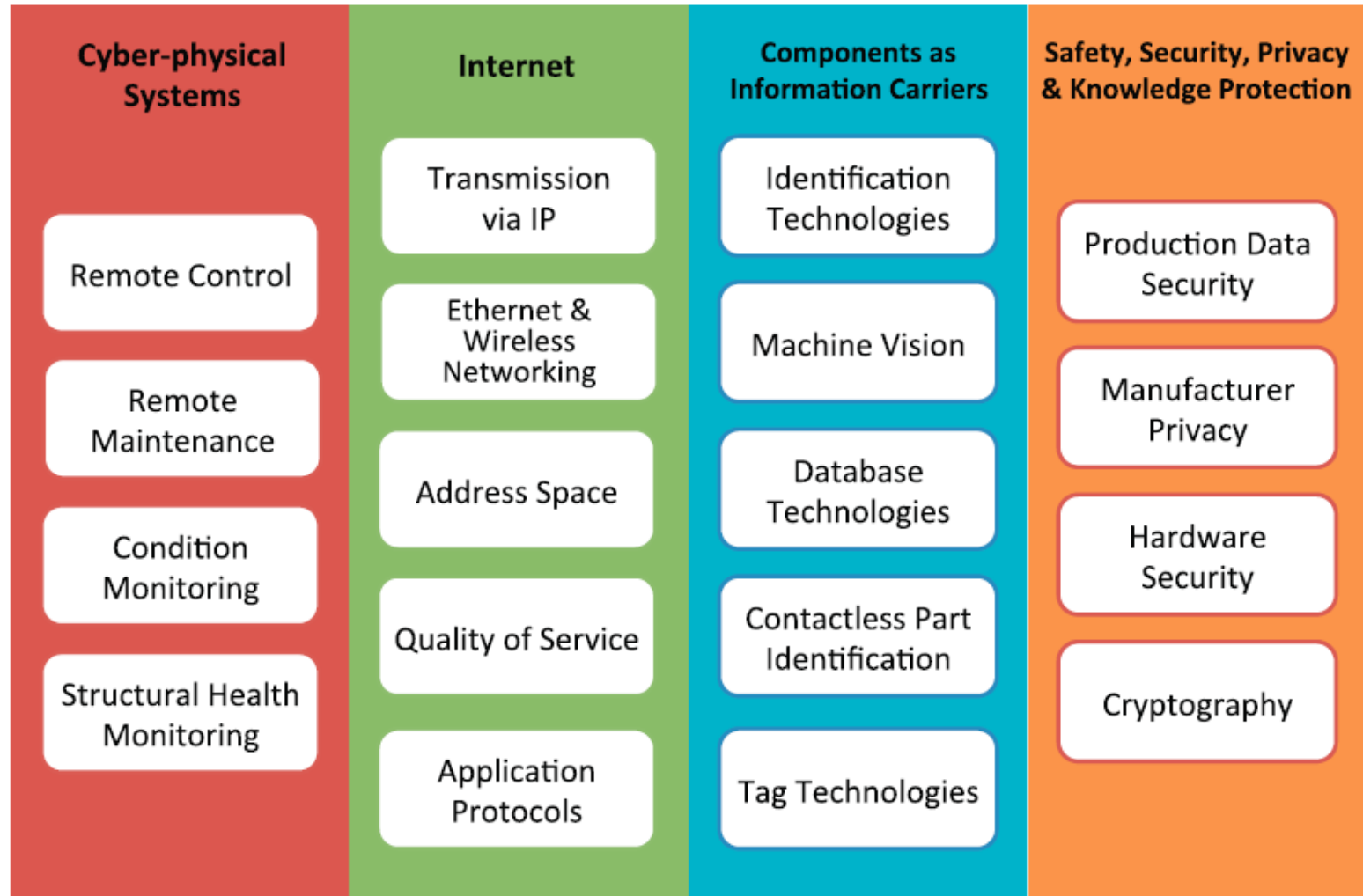
- Model Based Requirements Engineering,
- Model Based Systems Engineering extended by connectivity engineering, communication design and specification, web-services design, data analytics and knowledge generation.
- Developing sensor and actuator architectures fulfilling the requirements of
 - system safety,
 - functional system reliability,
 - system autonomy.
- Supporting Business Models



Design of Web-Services for Smart Products



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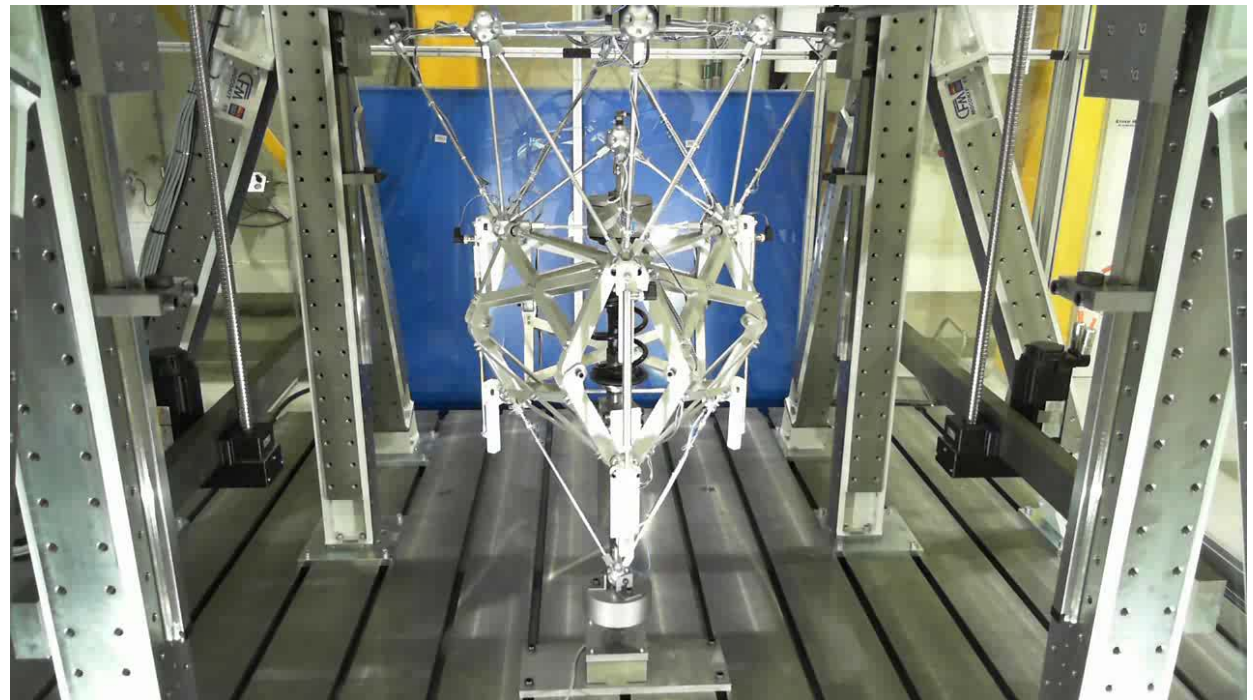
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Use Case CRC 805 – Physical Demonstrator for a Touch Down Event



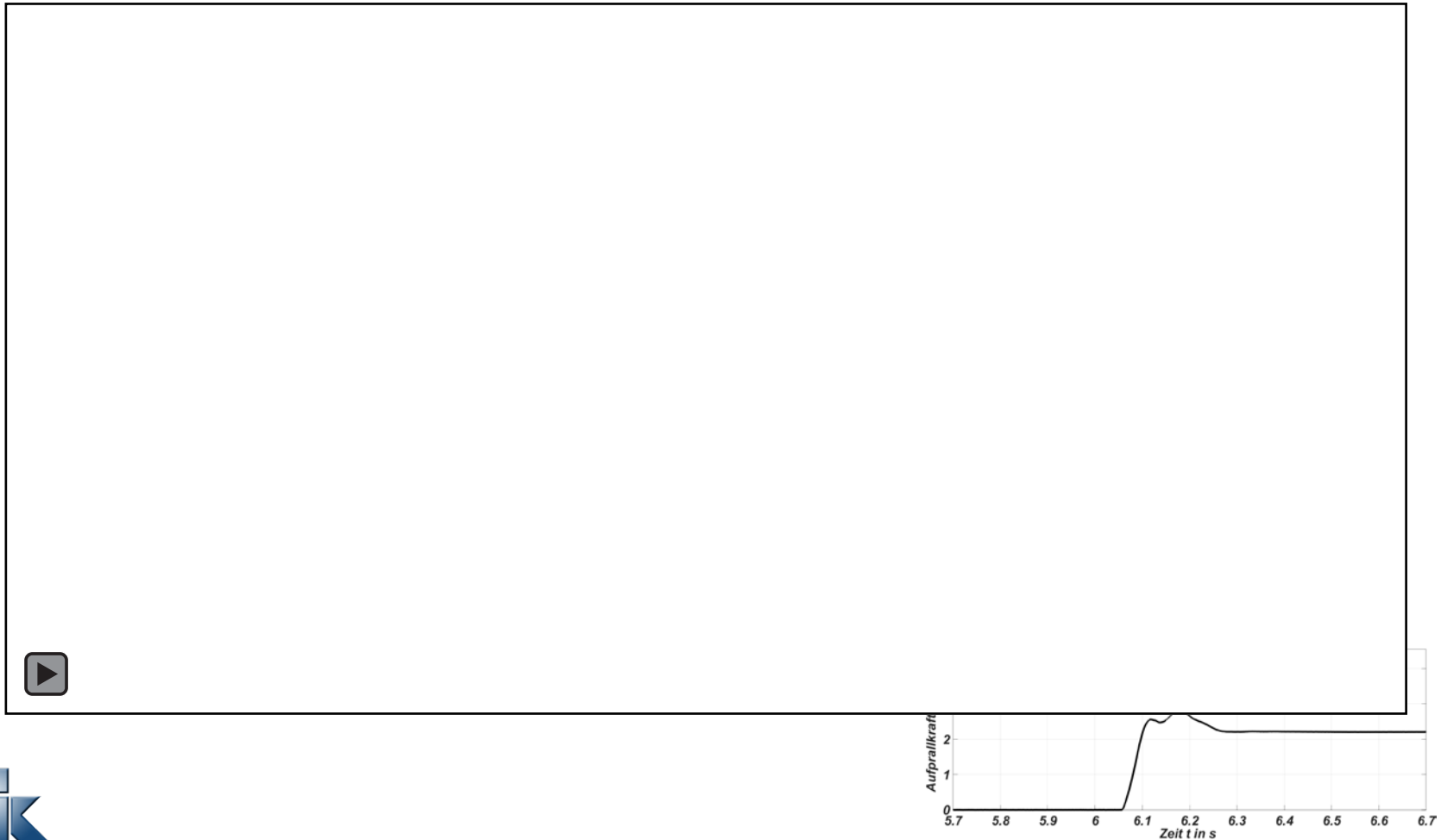
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Source: CRC 805, TU Darmstadt

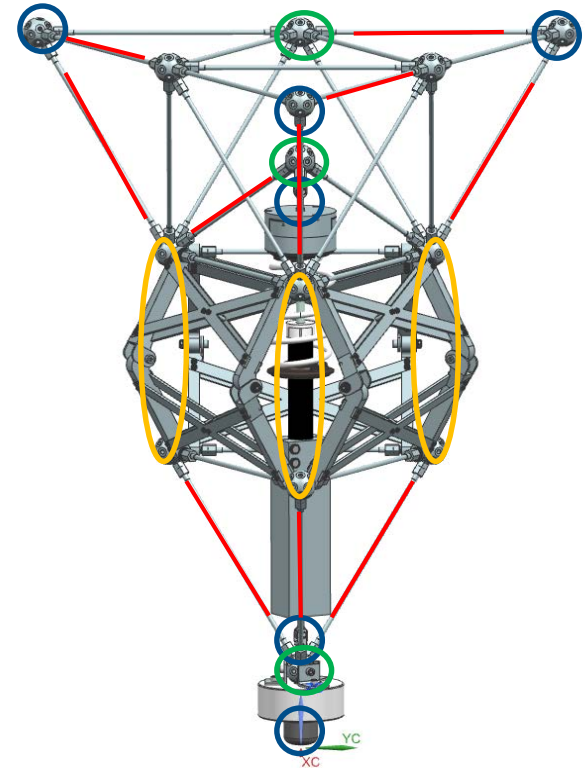
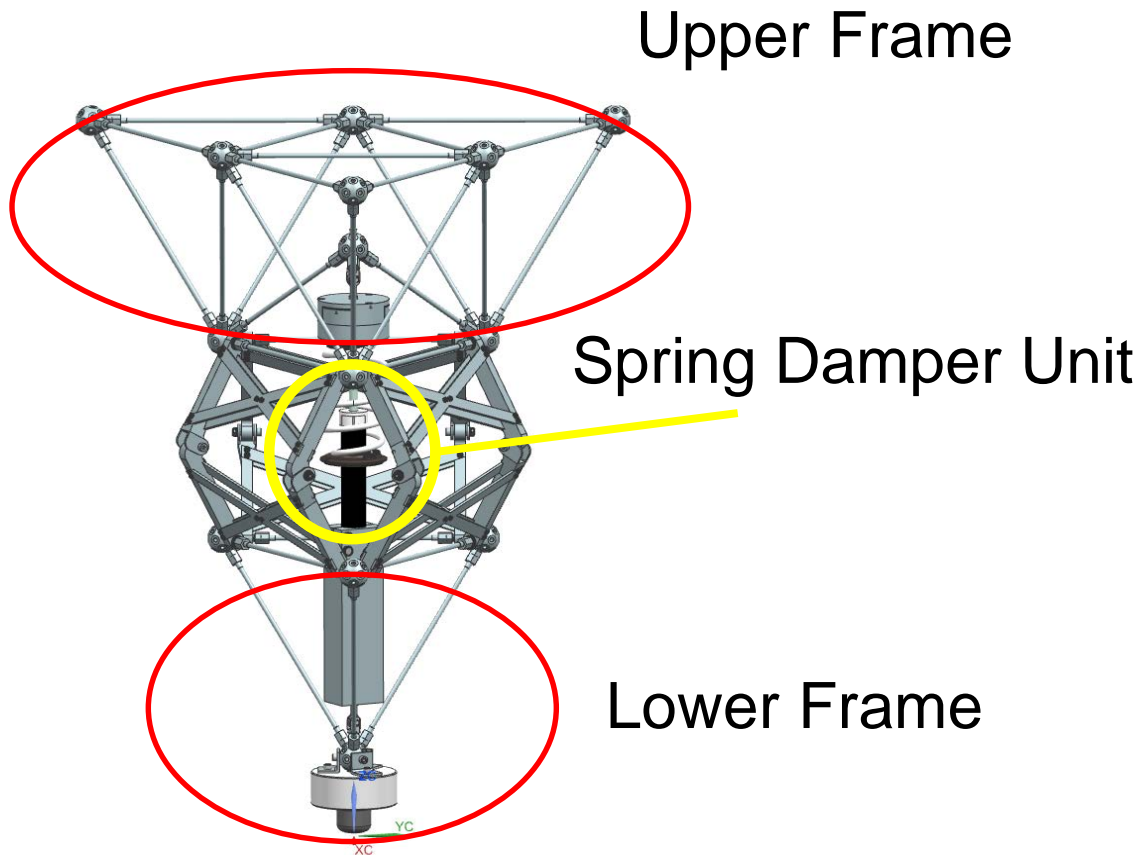


Use Case CRC 805 – Digital Twin for a Touch Down Event



Source: CRC 805, TU Darmstadt

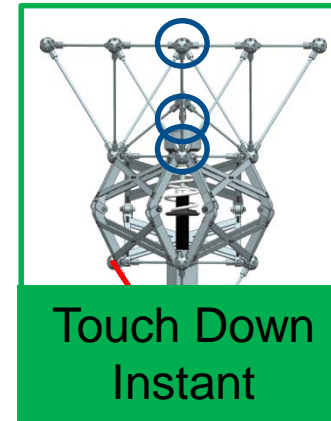
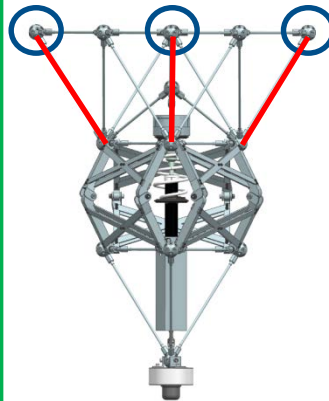
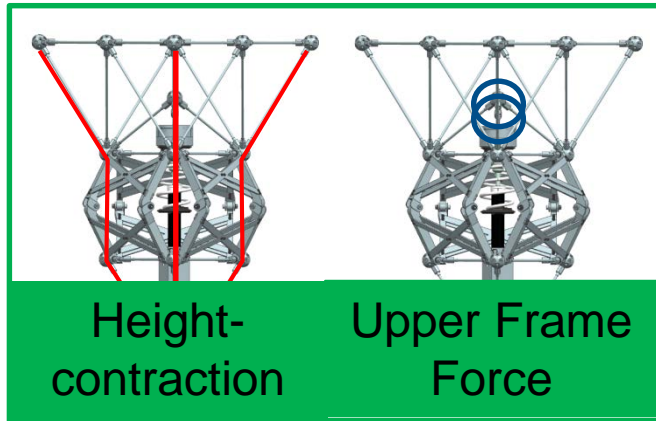
Use Case CRC 805 – Digital Twin for a Touch Down Event



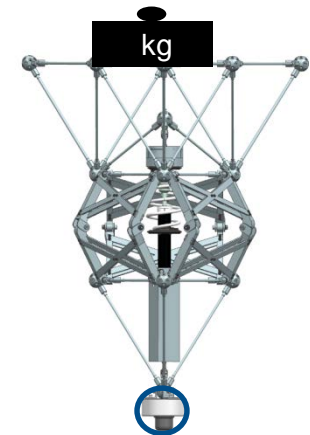
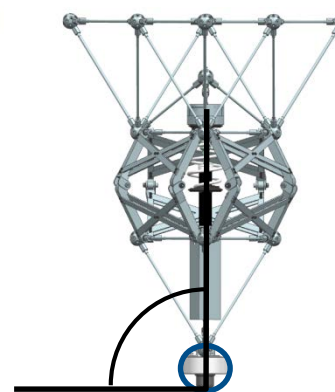
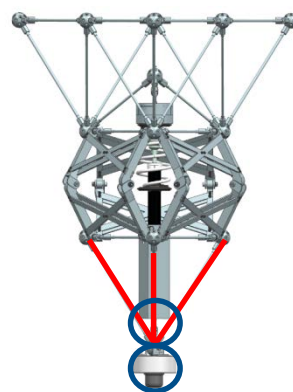
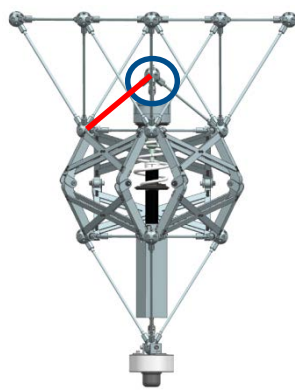
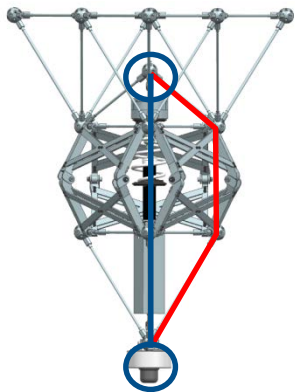
Sensors:

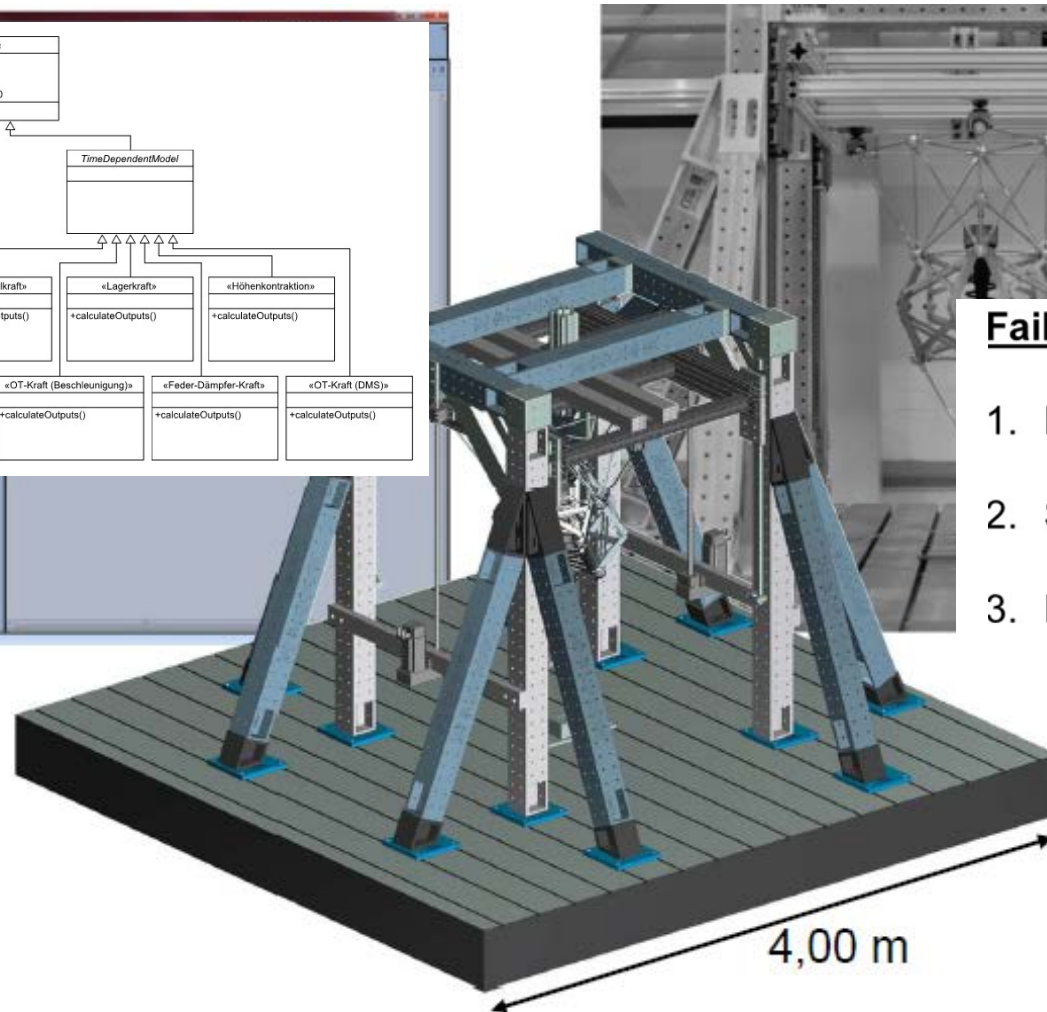
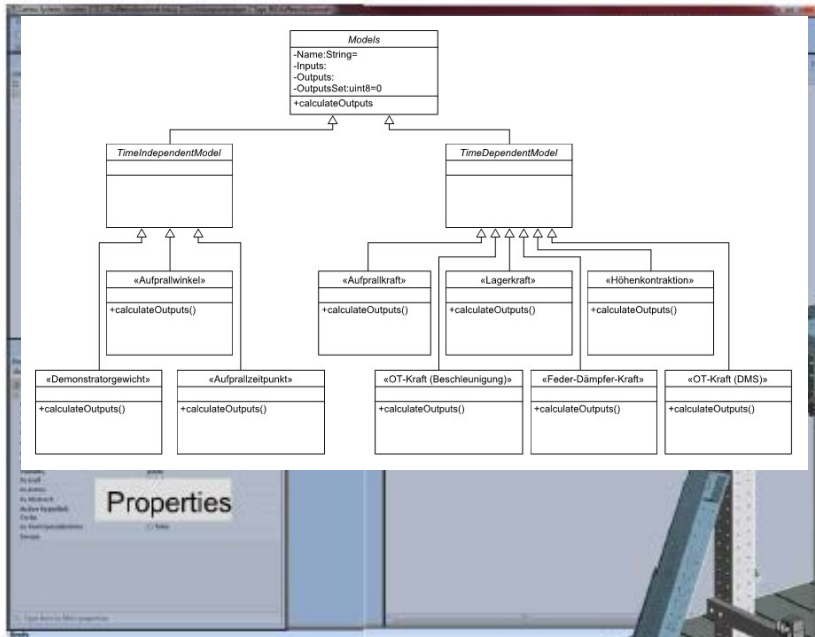
- Force Sensors
- Acceleration Sensors
- Path Sensors
- Strain Gauges

Use Case CRC 805 – Physical Demonstrator for a Touch Down Event



- = Force or Acceleration
- / = Strain Gauge or Path





Failure Scenarios

1. Modell Mistakes
2. Sensor Failure
3. Plausibility Errors

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Business Indicators Today

Business Models Tomorrow

Traditional
Innovation



Open Innovation

Innovation-
management, IPR

Value Added Chains
Production and
Supply Chains

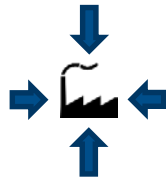


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1010
0101

Data driven
Added Value Chains

Global Delivery
on Demand,
Data Analytics

Centralized
Planning und
Control



Decentralization
Connectivity and
Communication

App-Software
Marketplaces

Individualization
based on Variants



Individualization based
On Customer Interaction
Agility and Flexibility

Customer Cooperation
and Satisfaction

Warehousing



Production on Demand

Individualized
Production

Competitiveness
Based on
Product Quality



Product and
Service Quality

Product Service
Systems

Smart Product Engineering and Smart Production

Engineering enabling New Business Models



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- Business Models are becoming a new requirement for both
 - Smart Product AND Production Engineering.
- New Business Models require data from both
 - Product usage AND Production operation.
- A new Design and Engineering paradigm is needed to satisfy the requirements for driving new Business Models.
- Model based digitalization throughout all Product Lifecycle Phases is a key issue which needs to be solved in order to strengthen industrial competitiveness.
- Smart Product and Smart Production Engineering still needs fundamental research and applied research as well as new approaches for the transfer of technology into industrial practice.

Thank you very much for your attention!



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*I cannot say whether things will get
better if we change;
what I can say is they must change if
they are to get better.*

Georg Christoph Lichtenberg (1742-1799)
German scientist, author and philosopher

Source: TU Darmstadt / kh-architekten