Welcome to LightCon Preview Week!

Towards smart Production: Sensors, Information Flow, Architecture and Analysis

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Towards smart production: Sensors, information flow, architecture and analysis

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LightCon Preview Week
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Smart Production- What is that? Why do we want to collect so much data?

Vision: From the mold into the aircraft

- Increased efficiency and productivity (e.g. virtual quality assurance)
- Scrap part prevention due to per part process optimization
Production process chain: Carbon fiber reinforced plastic (CFRP)

In: Raw material

Out: Part

source: myRTM, a new tool for RTM process design, jec composites magazine / No58 June - July 2010
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Phenomenon in Detail

• Impregnation of dry fiber material by resin due to pressure gradient
• Variability in raw materials can lead to different flow pattern that end in scrap parts

Ideal
Phenomenon in Detail

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iFeZ – intelligentes Formwerkzeug der Zukunft
iFeZ – intelligent mould of the future

Technologies for improved manufacturing processes in aviation:

• Implementation of a sensor-integrated and multifunctional mould within an intelligently networked production environment

• Active process design with the goal of sustainable part production
Component quality criteria
Field of application: Aviation and CFRP

1. Component property?
2. Property is objective describable?  
   ✔️ ✗
3. Magnitude?
4. Time of detection?
5. Used auxiliaries / tools?
6. Influencing factors and effect?
Component quality criteria
Field of application: Aviation and CFRP

- Void
- Shape accuracy
- Fiber volume content
- Resin condition
- Surface quality
- Fibre angle
- Cost-benefit ratio
- Ecological footprint
- Costs
- Residual stress

Häufigkeit Nennung
Digital Mock Up for retrofit an existing mold with sensor technology

- Ultrasonic Sensor
- Pressure Sensor
- Dielectric Sensor
- Thermo-couple
- Prozess Refractometer
- Eddy Current Array
- Eddy Current Sensor
- PiFeZ Data-Fusion
Result: Sensor-integrated mould

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Towards smart Production fusing Expert Systems
Information Flow

Pseudo digitalization

True digitalization

src: https://www.flaticon.com/de/
Architecture: Virtualization with containers and APIs

- Sensor service
- GUI service
- <insert purpose> service
- Yet another service

Service

Knowledge taker

GUI

src: https://www.flaticon.com/de/
src: https://mybusinesscentral.de/business-central-mit-docker-installieren/
Reminder: Detecting Defects during Production

...or something completely else?

...and what does that mean?
Field of Expertise: Flowfront monitoring with ultrasound sensors
1st Service: Architecture for process monitoring with ultrasound

Measurement hardware

Container
- Database
- Control system
- Dashboard
- Analysis Tools

Knowledge taker

Advanced knowledge taker

```java
put("...\ultrasound\single",
    json={'amp':10})
```

```java
get(".../database/ultrasound/last_measurement",
data={'channel':1}))
```

src: https://mybusinesscentral.de/business-central-mit-docker-installieren/
2nd Service: Architecture for advanced process monitoring of RTM-Processes

**Container**
- Database
- Control system
- Dashboard
- Analysis Tools

**Analysis and evaluation using flow simulation**

**System control**
- Adjust parameter
- Modify process steps

Measurement hardware

[Container](https://www.flaticon.com/de)
[Dashboard](https://mybusinesscentral.de/business-central-mit-docker-installieren)
Benefits

Transparent and efficient processes
- Reduced process times
- Lower quality fluctuations
- Reduced number of scrap parts

Preserving knowledge and making use of existing knowledge

Reduction of non destructive inspection by shifting quality assurance into production

Virtual certification of each individual component based on measured quality data
Outlook

Research platform „EVo“

- Complete RTM-chain
- Online Data acquisition
- Relational Database (Ontology)
- Digital Twin

Research platform „BALU“

- Large research autoclave
- Simulation and sensor-guided curing processes
- Virtual autoclave

Research platform „GroFI“

- Automated Fibre Placement
- Online and Offline Simulation of Multi-Robot Cells
- Online Structural Evaluation of Deviations
Want to get in touch?
Our systems are also mobile!

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