H4.4 - Summary of chapters 7.1 and 7.2 Of the thesis "Ansatz für ein prozessintegriertes Qualitätsregelungssystem für nicht stabile Prozesse" - Hans Dörmann Osuna

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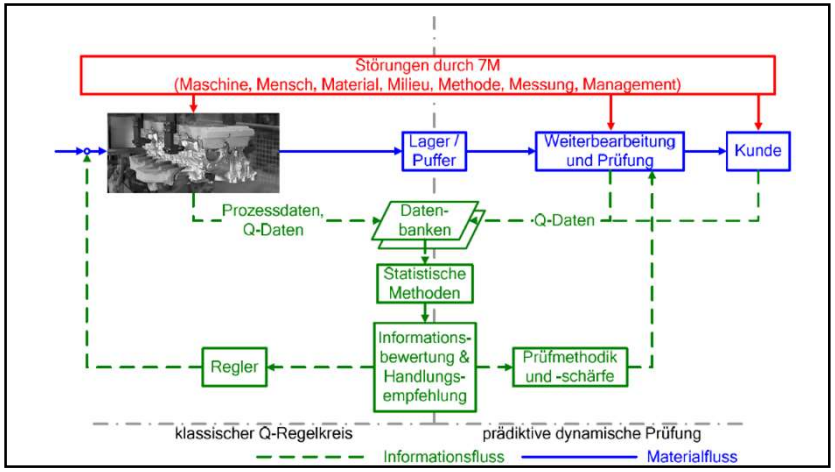
and Krister Wolfhard



Classic quality control loop (reactive)

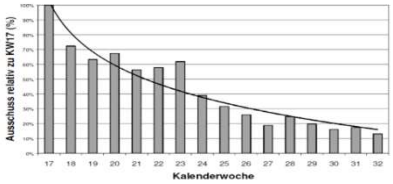
- Serves the timely detection and control of deviations
- Backwards chained
  - Measures do not affect the currently produced part
- Process parameters are statistically evaluated
  - Recommended action is derived
- Control variables of the parameters must be measurable and processable
  - z.B. temperature, pressure, ...

Data evaluation

- Takes place on the basis of decision-support systems
  - based on machine learning methods
    - E.g. decision trees
  - Data is prepared using data mining methods
- Data Understanding
  - Data set with required variables is created
- Data Preparation
  - Data record is prepared as required
    - Table with input and target values
    - Data may be summarized in sections

Data evaluation II

- Modeling and data analysis
  - Modeling through decision trees based on the data set
    - CART/CHAID decision trees
- Implementation
  - New target specifications are generated by models
  - Existing specifications are adjusted
  - Rules derived from the model are confirmed/refuted

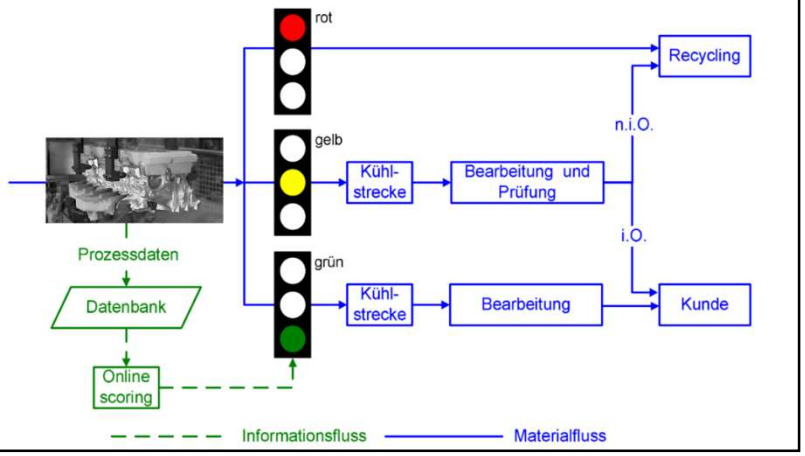


Predictive dynamic testing

- Same target parameterization of the systems as at the time of model creation
- No changes in the general conditions (i.e. change of tools), as these influences would not be included in the models
- Same environmental conditions as at the time of modeling

Change of general conditions → Anpassung des Modells

- Based on existing process and quality data
- Classification into three quality categories:
  a. Components that are highly likely to be good
  b. Components that are highly likely to be defective
  c. Parts that cannot be clearly classified



Forward quality control loop

- Base data for predictive testing:
  a. Historic data for model creation
  b. Current production data for prediction
  c. Current data for testing models
- Historic Data → Classification of parts

Methods of predictive dynamic testing

- Interactive procedures
- Non-interactive procedures cannot be changed accordingly
- All methods split data sets into training data and test data

- CART decision tree
- CART decision tree with defined Misclassification costs
- CHAID decision tree
- C 4.5 decision tree
- C 4.5 decision tree with different Pruning-settings
- Binary logistic regression
- neural networks

Methods of predictive dynamic testing

- Results of the methods can be "if-then-rules" or mathematical equations
- Future components receive calculation fields that are used to determine the probability
- Threshold values to determine the category