Unified inspection plan – A new model to improve the control of semiconductor product/production system

Partners

STMicroelectronics is a leading semiconductor company, a world key player thanks to our 43,200 employees including 8,300 working in R&D. ST's products are found everywhere today. Together with our customers, we are enabling smarter driving, homes, factories, and cities, along with the next generation of mobile and Internet of Things devices. Everywhere, microelectronics makes a positive contribution to people lives, ST is there. In 2018, ST is ranked by the Randstad Employer Brand Research Award among the 5 most attractive companies in France, for our values of excellence, our integrity and the respect of our employees.

LCFC (Laboratoire Conception, Fabrication, Commande) – Arts et Métiers in Metz is a research laboratory that aims at developing future production systems in the fields of services and manufacturing industry. Its main research topics are: to develop tools to invent, design, organize, pilot and control production systems, to produce while guaranteeing quality, reliability, safety and health at work, to develop new manufacturing processes and their associated production systems, and to design functionalities and uses with high technological value.

ERPI (Équipe de Recherche sur les Processus Innovatifs) – Université de Lorraine in Nancy is a research team on Industrial Engineering specialized on the research of innovation processes management. Its activities concerns the methods, tools and knowledges allowing to optimise innovation projects management. The scientific project of the ERPI deals with the Fuzzy Front-End off innovation, digital transformation, Lean management and decision support systems. ERPI differs to other innovation research laboratories by considering the product as a "integrating system".

Context

This PhD project is a collaboration between STMicroelectronics and LCFC and ERPI laboratories. During the production process (called route), a large quantity of data is collected in real-time and then stored in the appropriate databases. These data include, among others, sensor data, measurement data and maintenance data. The figure below shows a simplified schema of a process control plan at STMicroelectronics and its methods. Fault Detection and Classification (FDC) system is implemented to monitor the production in real-time using different implemented sensors, unlike SPC (Statistical Process Control) method, which uses measurement data recovered at the end of the processing operations. R2R (Run to Run) controller uses measurement data from previous runs (operations) and subsequent runs (feedforward and feedback respectively) as input to modify recipe parameters for subsequent runs. When planning a new route, the team uses historical data (SPC, FDC, process capability index Cpk) from similar recipes in order to establish the new control plan; including the inspection plan. Some data are related to the product (ex. SPC); others are related to the production equipment (ex. FDC). Some data are real-time data; others are historical. There is a significant lack of coherence between data from different sources. The different monitoring systems (FDC, SPC, R2R, etc.) are used independently of each other. Indeed, possible correlations and relationships between measurements and production system parameters are not identified. There is a real need to harmonize the different data and to

aggregate them in a synthetic way in order to allow a better understanding and control of the process and, consequently, a unified control of the process & product quality. The correlation and interpretation of the different data is currently done by STMicroelectronics experts in a manual way. In this context, the objective of this PhD thesis is to propose a model of correlation and harmonization of the data in order to estimate the risk of the different operations in real-time. Based on this model, a unified inspection plan could be defined in order to generate a joint and real-time product/production process action plan. This unified action plan will contribute to the improvement of the production process by minimization of the risks and the cost of quality control.
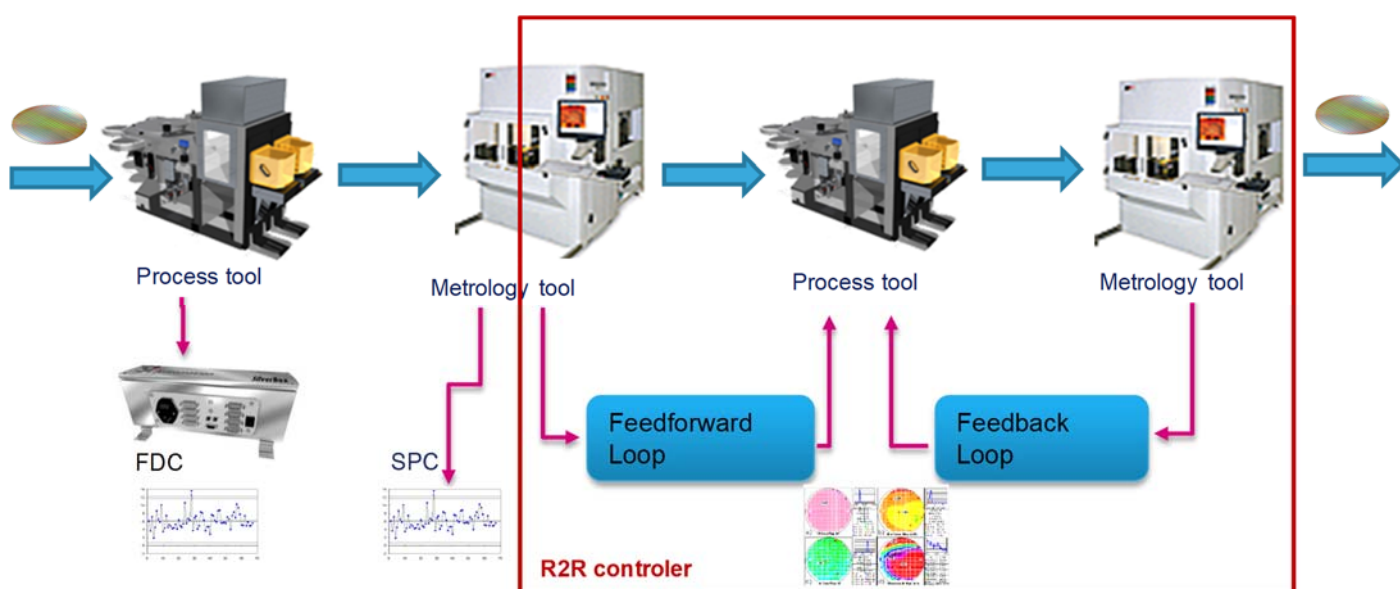
Objectives of the PhD

This PhD thesis will address a unified control plan integrating different process control techniques. Its objectives can be summarized by:

- ✓ To propose a model for the process recipe in order to formalize the different types of data and to establish the relationships among them,
- ✓ To propose a global framework integrating process control tools and methods (SPC, FDC, R2R…),
- ✓ To propose a unified inspection plan in order to generate a real-time product/ production process action plan based on risk assessment allowing complete vision on detection weakness. The risk coverage and reduction will be one of inputs that are more important,
- ✓ To develop methods/tools to generate/select the action plan and evaluate their performances,
- ✓ To conduct different industrial case studies at STMicroelectronics in order to test and validate the proposed framework.

Organization

The PhD will mainly take place at STMicroelectronics in Crolles, France (duration of presence 70%), in collaboration with the laboratories LCFC in Metz and ERPI in Nancy.

PhD to start in beginning 2021

Profile

The candidate must hold a master's degree or an engineering degree in the field of Industrial Engineering or Mechanical Engineering. He/She must have skills that had better cover the following areas:

- Risk assessment and management methods
- Database and Knowledge development
- Production systems modelling and evaluation
- Data analyses, process control and decision making techniques.

For better interaction with the proposed PhD project, it is desirable that the candidate be curious and skilled in technology and be motivated to work in an operational industrial environment.

An introduction to research (knowing how to conduct a bibliographical study, how to write a scientific paper and present his/her work) is highly appreciated.

Contact

To apply for this thesis offer, please send:

- An updated CV,

- A cover letter emphasizing the suitability of the PhD thesis project,

- Transcripts of grades obtained in the master's degree and/or engineering diploma,

- The last report written,

- Two letters of recommendation.

Please send these documents to   ali.siadat@ensam.eu

aymen.mili@st.com

alaa.hassan@univ-lorraine.fr

Application form is also available on:

https://stcareers.talent-soft.com/job/job-these-cifre-risk-based-control-plan-m-f_3815.aspx

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