Popular science summary of the PhD thesis

PhD student	Georg Ørnskov Rønsch
Title of the PhD thesis	Model-based process surveillance and optimisation for fault detection and diagnosis
PhD school/Department	DTU Compute

Science summary

With the introduction of Industry 4.0, focus on digitisation and digitalisation have become very apparent. Many companies have this high on their agenda, and many resources are spent on adjusting the overall ideas and concepts to fit within the context of the given company. One of the central aspects of Industry 4.0 is the utilisation of data to achieve increased productivity, new products, and business opportunities. This industrial PhD thesis focuses on utilising manufacturing data to achieve increased productivity and has been conducted in close collaboration with an industrial partner. The industrial partner is a leading producer of injection moulded construction toys. Therefore, the work is related to injection moulding; however, the findings and learning generalise well to other industries. The contribution of the conducted work is two-folded in the sense that part of the work has been related to formulating a practical approach for effective data utilisation within manufacturing and the other related to investigating concrete applications of data utilisation within injection moulding.

A framework is proposed for effective scoping and exploring data utilisation in a complex manufacturing setting. A clear business objective is the foundation for structuring and prioritising potential data utilisation applications. Following the framework will ensure maturing the needed skills and infrastructure to effectively introduce data-driven applications in a manufacturing environment.

It is explored how to utilise underlying time-resolved machine data to capture process dynamics that aren't captured by the readily available machine process data. It is possible to detect and adjust for process disturbances impacting product quality by utilising this. This has been demonstrated using a combination of design experimentation and machine learning.

Acoustic emissions have been explored for real-time condition-based maintenance of injection moulds. To reduce the number of models to develop and maintain it is, in the context of multiple alike equipment's, desirable to create global models that can be used across multiple equipment's. It has been shown that this can be achieved using the frequency components of the acoustic emissions combined with Gaussian modelling and model adaptation.

Process monitoring for injection moulding has been explored using readily available process data. MSPC-PCA have been used to overcome challenges with correlation between variables. It has been found that the moulding process operates in multiple production regimes, with production of faulty products randomly distributed among these regimes. Because of limited data, it has not been possible to conclude this work. More needs to be investigated to determine the best approach for process monitoring within the injection moulding setup used at the industrial partner.

Popular science summary of the PhD thesis

PhD student Georg Ørnskov Rønsch

Please email the summary to the PhD secretary at the department