Editorial

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Biographical notes: Ridha Hambli is a Professor at Polytechnique Orleans. He is involved in research in the development of multiscale and objective methods for product development. He is also managing research dealing with neural network solutions for management, engineering and informatics applications. He is the author of about 100 papers in international journals and conferences.

Damien Soulat is an Associate Professor at Polytechnique Orleans. His research activities concern the development of forming processes, including those of metallic alloys and composite materials. He is also involved in research dealing with finite element modelling for several domains such as mechanical structures, biomechanics, and simulation of forming processes. He has contributed about 60 papers in international journals and conferences.

Fabrice Guérin is a Professor at the University of Angers. He teaches courses on mechanical technology, statistics, metrology and reliability. His technical interests lie mainly in mechanical reliability, Bayesian statistics and accelerated testing.

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With the intensifying competition in industry, product design and development is becoming more vital to the prosperity or survival of companies. Product design and development is a complicated task which involves different disciplines, such as management, design, manufacturing, marketing and organisation. In addition, the design and development of products involves many actors who have different interests and different development tools. Multidisciplinary collaboration is a complex domain, in which all the actors need to exchange and share product and process information. In fact, product information generated by each actor is communicated to all actors in order to integrate them in a shared representation.

Different levels in product development determine the structure of the tasks; the boundaries are established between tasks, the design and location of each task's production process, and the aggregation of the resulting products into completed projects. Designers, fabricators and contractors each have some specific inputs and outputs. This standard practice typically strives to maximise performance in the preparation of each piece, so project participants often become blinded to important opportunities for improving the overall project performance scope of work structuring by equating it with production system design. On the other hand, companies need to maintain a balance between product performance and product quality and reliability.

The research in the framework of quality and reliability aims to control and to improve the quality and reliability of products, focusing on the analysis, design and control of the relevant technical-operational business processes. In this context, control implies both the modelling and analysis of product quality and reliability.

In addition, application of the European directive in 2002, relating to a harmonisation of consumer protection (in particular in terms of periods of guarantees, and thus of reliability), pushes the companies to develop increasingly reliable products. Consequently, systems engineering is becoming an increasingly important approach to tackling product integration and life cycle considerations, including quality and reliability of the products and processes approach, which must integrate product-process-organisation design stages.

Companies spend millions of dollars improving product reliability and quality every year and for evaluating reliability through testing and data collection. Generally, design and production decisions are based on life test data, often from a few units. For some products, the testing time necessary to provide adequate reliability assurance under normal operating conditions might be very long and very expensive. Reliability-data gathering should not hold up development, and should be as economical as practicable, so it is important to be able to conduct reliability tests as quickly as possible, consistent with obtaining meaningful results.

In several technological areas, attaining very high reliability levels is strongly required. However, a high reliability level of systems obviously induces a high reliability level of components. This leads to the problem of scarcity of component life data in an acceptable testing time. The Accelerated Life Testing (ALT) of a product under severer than operating conditions involving high temperature, humidity, voltage, *etc.*, is commonly used to reduce testing time and cost. The main problem is to estimate accelerated life model parameters allowing the definition of the reliability function under operating conditions from only accelerated life data. A difficulty of using the ALT, during design stage, is the small sample size to test.

In this context, the Bayesian approach can be used to incorporate into the estimation process all available knowledge on accelerated life models (baseline failure rate, activation energy, *etc.*).

The Bayesian approach coupled with statistical analysis such as Monte Carlo simulations can be applied to ALT to have a better and more precise estimation of reliability.

This special issue deals with both academic and practical contributions in all aspects of Quality and Reliability of Products and Processes. The selected papers cover the following topics:

- accelerated testing
- Bayesian technique and statistical modelling
- tests planning
- computer aided design
- integrated product design and development processes
- forming and manufacturing systems.