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## **Geometric variation included in computer modelling and a Digital Twin as an opportunity to get adaptive manufacturing**

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Since the early works by Shewhart and Deming manufacturing is mainly controlled by adapting a design and its tolerances to the statistical variation of the process. In design development work there is a challenge to take into account variation and uncertainty in connection to geometrical outcome for products where fabrication is used, where bits and pieces are joined together by welding.

Geometry assurance method is a computational tool that on a hands-on way can study the outcome on how the assembly and fixture handle the variation outcome of the bits and pieces by Monte-Carlo simulation.

When a welding process is used welding deformation is coupled to the geometrical variation of the part. By introducing the digital twin concept for fabrication process of components, the idea is to reach in detail control of incoming part geometries. This will also affect the functionality of the component such as the detrimental effect on life and strength that is seen in terms of rest tensions and non-perfect geometries that can be overcome.

In this study it is shown how a digital twin model can be applied when manufacturing a hardware and how the aspects of variation with good fitting for final fabrication of weld assembly can be achieved.

Still adaptive manufacturing is performed in the laboratory. Once accurate prediction is achieved, the result needs to be brought back into the physical process.

### **Keywords**

Statistical Process Control, Geometric variation, measurement system, problem solving, computer modelling

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