

Optimisation of Metrological Inspection of a Developmental Aeroengine Disc

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Abstract : Fan technology is very critical and crucial for any aero engine technology. The fan disc forms a critical part of the fan module. It is an airworthiness requirement to have a metrological qualified quality disc. The current study uses a tactile probing and scanning on an articulated measuring machine (AMM), a bridge type coordinate measuring machine (CMM) and Metrology software for intermediate and final dimensional and geometrical verification during the prototype development of the disc manufactured through forging and machining process. The circumferential dovetails manufactured through the milling process are evaluated based on the evaluated and analysed metrological process. To perform metrological optimization a change of philosophy is needed making quality measurements available as fast as possible to improve process knowledge and accelerate the process but with accuracy, precise and traceable measurements. The offline CMM programming for inspection and optimisation of the CMM inspection plan are crucial portions of the study and discussed. The dimensional measurement plan as per the ASME B 89.7.2 standard to reach an optimised CMM measurement plan and strategy are an important requirement. The probing strategy, stylus configuration, and approximation strategy effects on the measurements of circumferential dovetail measurements of the developmental prototype disc are discussed. The results were discussed in the form of enhancement of the R & R (repeatability and reproducibility) values with uncertainty levels within the desired limits. The findings from the measurement strategy adopted for disc dovetail evaluation and inspection time optimisation are discussed with the help of various analyses and graphical outputs obtained from the verification process.

Keywords : coordinate measuring machine, CMM, aero engine, articulated measuring machine, fan disc

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