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Advances in 3D Measurement Data Management for Industry 4.0

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Abstract

A project group entitled "3D Measurement Data Management" was set up in 2016 under the joint auspices of the VDA (German Association of the Automotive Industry) and the ProSTEP iViP Association to develop a specification for 3D measurement data management. This article provides an introduction thereto and describes current challenges faced by the industry along with the group's aims inside the ProSTEP iViP community which currently comprises 180 international members across the globe.

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Keywords: 3D; Measurement Data Management; Process Chain

1. Introduction

In global markets, production of complex products is accomplished in supply chain networks around the world. It requires an increasingly seamless exchange of information to ensure not only quality but also faster time-to-market in a system of collaborating systems [1]. As a building block of interdisciplinary data management, the need for comprehensive measurement data management (MDM) arises [2]. An intelligent MDM thereby enables an enhanced automation of operations, consistent quality control, increased efficiency of single process steps and improved early risk identification [3].

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As far as MDM is concerned, a robust product lifecycle management (PLM) must provide support for product quality characteristics from early design phase throughout production downstream. This, however, is still a challenge for current implementations. An excellent handling of geometrical dimensions and tolerances (GD&T), product manufacturing information (PMI) and measuring point definitions are necessary to overcome these challenge. A paperless product quality management [4] strengthens those measures and is essential for a quality management fulfilling Industry 4.0 standards [5],

In spite of the continuous trend towards digitalization, seamless data continuity and exchange, massive use of paper is state-of-the-art in measurement process [6]. Required information is reported incompletely and inconsistently particularly in measurement planning. Descriptions provided by standards - such as the integrated product model described in ISO 10303 (STEP) - are inapplicable [7]. That lack of standardized interfaces is painfully noticeable as illustrated in Fig. 1.

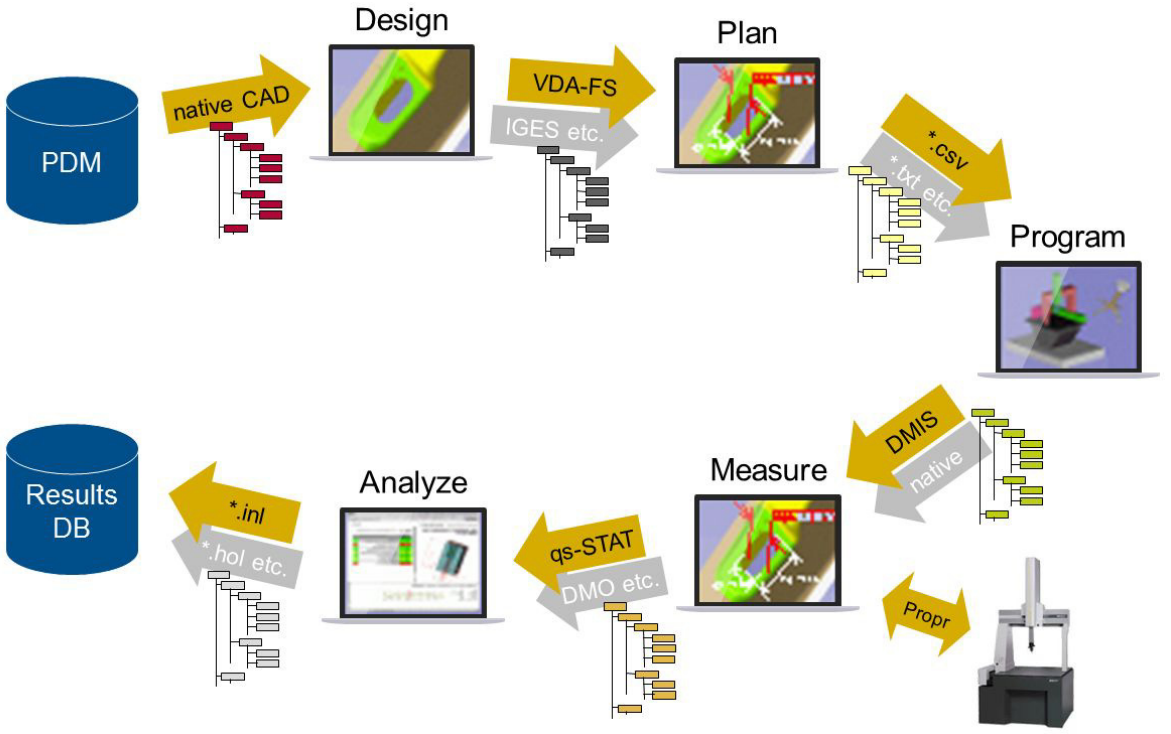

Fig. 1. Interfaces in a typical measuring process [8].

As far as the automobile industry is concerned, a plethora of different measuring devices and methods is used to ensure product quality [9]. They differ in their functional characteristics, performance, and their level of integrability into cross-functional PLM processes [10] [11].

Effective MDM discovers high optimization potential for cross-functional interoperability across domains [12][9]. Herewith, a consistent digital availability of product features falls in particular to 3D measuring technology [8]. Material flow and information flow of production especially demand integration to make larger use of measuring devices in automated production [13]. Digital measurement aspects allow a more efficient use of measurement information in production [14] [15]. An automated data exchange realizes another efficiency enhancement [16].

The multitude of devices and processes found in the automotive industry has always provided fertile ground for the harmonization of processes and methods [2][17]. The desire for a standardized interface for the flexible design of the measurement process, with its numerous participants and objects, is, therefore, a logical consequence.