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INTEGRATION OF 3D LASER SCANNING INTO TRADITIONAL DES PROJECT METHODOLOGY

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ABSTRACT

Today's product development cycles demand manufacturing system development to meet ever changing product requirements and shifting production volumes. To assess and plan production capacities, companies rely on decision support from simulation and modeling. The simulation models are used to test and verify scenarios in a non-disrupting environment. To efficiently model a manufacturing system physical familiarity with the real system is often necessary. Likewise, to communicate the results of a simulation model, its visual resemblance to the studied system provides input for decision makers. 3D laser scanning offers photorealistic 3D capture of spatial measurements and has successfully been used in manufacturing environments. This research proposes the integration of 3D laser scanning into a traditional simulation project methodology in order to aid decision-making. Some promising stages for integration have been identified based on a technology demonstrator in the aerospace industry.

1 PROBLEM DESCRIPTION

Globalization puts ever increasing pressure on industrial companies to develop new products and cut production costs. Thus, in most in production systems, change become necessary over time. Discrete event simulation (DES) is one proven tool to plan and predict the effect of changes to a production systems.

DES modeling frequently requires a simulation specialist to build the model and analyze the results (Musselman 1994). Often times the simulation specialist isn't an expert on the specific production stages of the studied system. Therefore information and explanations has to be provided by e.g. production engineers, machine operators, and production planners. There are many methods described for communicating such information, but their success all depend on the ability of the involved parties to share the same understanding of exactly what information that is the topic of discussion (Banks et al 2005, Musselman 1994). Since that understanding is internal to each participant mistakes and misunderstandings are not uncommon, in fact they are listed as the most common reason for unsuccessful simulation projects (Musselman 1994).

One way of improving the shared understanding is to meet on site when the different productions stages are to be explained, i.e. take a tour of the factory. However, often times new questions will arise as the work progresses and further explanation has to take place. If the analyst is not on site or if the system is not accessible at all times this will cause additional travel costs and/or time delays.

3D imaging technology exists that has the capability of capturing spatial data in scale one to one and enabling photo realistic rendering of the captured environment. If such technology where to be used, the captured environment could be accessed virtually for the purpose of explaining the workings of the production system. Furthermore the 3D data representation, often termed point cloud, can be used as visualization in the simulation model, augmenting or even replacing the currently prevalent CAD-models. This work proposes several ways of leveraging captured 3D data to facilitate DES modeling and results.

2 LEVERAGING 3D LASER SCANNING TO FACILITATE DES MODELING

Having accurate, updated and life sized 3D data of a system can be beneficial in many stages of a DES project. Added value can be achieved for example in the earliest phases of a project as a visual support during conceptual modeling when the different production stages are to be explained and defined (Lindskog et al. 2013). Presented below, in Table 1, is a list of when and how point cloud data can benefit during a DES project.

Table 1: Point cloud data usage at different stages in a DES project.

Step	Used for
Problem Formulation/ Setting of Objectives	*Communication Aid:* Using point cloud data for factory walk through during start-up meetings to improve system understanding
Model Conceptualization	*Communication aid:* The simulation analyst can use the point cloud data to better communicate with system experts, e.g. operators and maintenance personnel
Data Collection	*Accessible view of system:* The simulation analyst can visit the point cloud model of the factory to familiarize with the system
Model Translation/ Building	*Measurements and Graphics:* Use the scan data as canvas and background for the model building of existing production equip.
Documentation and Reporting	*Visualization:* The simulation analyst can use the point cloud data to realistically visualize the future state
Implementation	*Spatial knowledge:* The factory constraints are known and change suggestions can be assessed also in the spatial domain.

3D-imaging technology will become ever more prevalent and easier to access in the future. For the DES community to benefit from this development, structured work methods and best practices on how to include point cloud data in DES projects are needed. This work proposes some promising starting points for integration of captured 3D point cloud data into DES projects using a traditional DES project methodology. Some perceived benefits of using point clouds are; accurate location data for production equipment and better spatial visualization for users. The integration of point cloud data and DES has been tested in a pilot study at a company in the aerospace industry.

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