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FRAUNHOFER-INSTITUT FÜR FABRIKBETRIEB UND -AUTOMATISIERUNG IFF, MAGDEBURG

1 *Visualization of the assembly inspection result for parts mounted on aircraft structural elements.*

FLEXIBLE MODEL-BASED ASSEMBLY INSPECTION

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OPTOINSPECT
3D Measuring Device

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Highly customized products, small lots and short product life cycles are challenges advanced industrial assembly processes have to handle. Frequently, only manual or hybrid semi-automatic assembly is flexible enough.

Highly variable, complex assemblies put together manually are especially prone to subjective errors and additional costs, for reworking for instance. Optical systems that inspect the outcome of assembly operations contribute greatly to organizing processes cost effectively and reliably. Employing a model-based approach, the Fraunhofer IFF in Magdeburg developed a technology that optically inspects assembly and completeness, which is highly flexible, adaptive and robust.

Key Features of the Technology

- Inspection of completeness and correctness of assembled components
- High flexibility for changing inspection tasks and ranges of components
- Automatable inspection planning based on CAD data
- Optical scanning of components with camera images and 3D data
- Extraction of reference data from simulated measurement on CAD models (synthetic images and 3D data)
- Inspection by comparative analysis of synthetic and real measured data
- Ideal for complex and highly variable assembly operations
- Scalability and universality

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Conventional Assembly Inspections

An assembly operation produces assemblies of individual components or finished products. Objective inspection of the process checks components presence and correctness, i.e. type, mounting position and orientation, to assure that the outcome of assembly operation is correct. Conventional optical inspection systems frequently employ fixed camera configurations that scan inspected components. Since the actual/nominal comparison usually relies on taught in reference images, such systems are incapable of responding to changes in the scope of inspection flexibly.

Model-based Approach

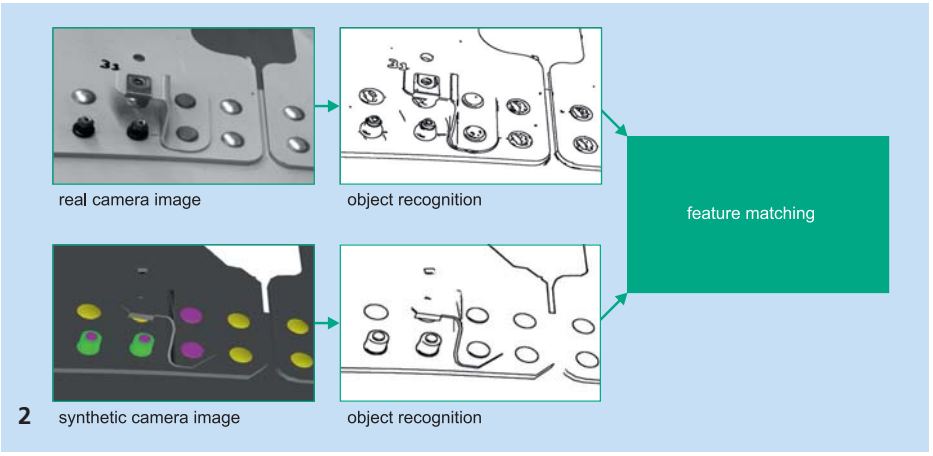
The newly developed assembly and completeness inspection technology pursues another path that boosts the flexibility and robustness of such solutions. The approach is model-based and uses CAD data of inspected assemblies and a modeled description of the measuring setup.

Synthetic Reference Data

Simulated measurement is the key element of model-based assembly inspection. A digital camera's optical imaging is simulated, thus generating synthetic camera images of CAD data. For complex inspection tasks, the system is extended with three-dimensional camera sensors so that simulated measured 3D data are available as specifications.

Actual/Nominal Comparison

Assembled components or assemblies are actually inspected by comparing recorded measured data with simulated data. (See the graphic of the inspection procedure based on camera images.) Edge filters are applied to segment, extract and reference the various objects for comparison.



Inspection Planning Based on CAD Data

The model-based approach additionally renders inspection planning flexible and automatable. Optimal sensor positions are determined by simulating measurements. Whenever the inspection task changes or new components are added, the related inspection programs are modified automatically or generated a new. Teaching is unnecessary.

Scalability and Flexibility

The technology is scalable and universally applicable. Image-based and 3D feature scanning can be selectively combined in conjunction with model-based reference data generation to produce more flexible and robust optical assembly and completeness inspection systems.

Our Services for You

Based on this technology, we can develop solutions customized to your needs, from the idea through integration in your process.

1 *Data acquisition of an assembly result.*

2 *3D actual/nominal comparison with synthetic data in principle.*

Pictures: Fraunhofer IFF