Master Thesis - Digital Twin Development for Automated Visual Inspection Using Physically Based Rendering - (30 credits/20 weeks – 1-2 students)

About us

GKN Aerospace is the world's leading multi-technology tier 1 aerospace supplier. With 33 manufacturing locations in 12 countries, we serve over 90% of the world's aircraft and engine manufacturers. We design and manufacture innovative smart aerospace systems and components. Our technologies are used in aircraft ranging from the most used civil aircraft to the world's advanced 5th generation fighter aircraft and the Ariane orbital rockets used by ESA.

Project Background

Automated Visual Inspection (AVI) systems are increasingly used in modern manufacturing for quality assurance and defect detection. However, configuring an inspection system typically requires extensive experimentation with camera positions, optics, lighting arrangements, and robot viewpoints. These setups are often determined through repeated physical trials, making the commissioning process both time-consuming and costly.

Recent advances in Digital Twin technology and physically based rendering offer new possibilities for virtual commissioning of inspection systems. Blender, an open-source 3D modeling and rendering platform, provides ray-tracing capabilities that can realistically simulate camera optics, lighting conditions, and surface interactions. This creates an opportunity to evaluate and optimize inspection configurations in a virtual environment before deploying physical hardware. The aim of this thesis is to investigate the feasibility of using Blender as a simulation platform for Automated Visual Inspection and to assess its potential for reducing setup effort, commissioning time, and development costs.

Assignment Description

Student(s) are expected to:

- Develop a Digital Twin of an automated visual inspection station in Blender
- Model cameras, lighting systems and inspection targets within the virtual environment
- Generate synthetic inspection images and evaluate their accuracy against real images

Depending on interest and background the student(s) may also focus on one of several topics:

- Investigate the feasibility of simulating unconventional imaging methods, such as polarimetric and spectral imaging
- Optimization of camera and lighting configuration for improved defect detection

Qualifications

- Master's student in Mechanical Engineering, Engineering Physics, Computer Science, Robotics, Automation, Manufacturing Engineering, or a related field
- Interest in one or more of the following areas:
    - Robotics and automation
    - Computer vision/ Computational imaging
    - Computer graphics
    - Smart manufacturing and digital twins
- Programming experience in Python and/or C++ is beneficial
- Experience using Blender or similar software is a merit
- Curious, independent, and motivated to solve challenging industrial problems

Apply by

Send your resume and cover letter to Erik Karlsson Öhman.

Last date to apply: Applications will be reviewed on a rolling basis.

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