ASTOR: An Autostereoscopic System for Spatial Augmented Reality

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INTRODUCTION

The combination of real and virtual objects in Augmented Reality (AR) requires see-through displays, such that the physical environment and the computer-generated 3D graphics can be seen *simultaneously* and in *real-time* [1]. Optical see-through displays are the preferred choice in many applications in which a direct view of the world is desirable and are, for instance, necessary in industrial applications due to safety and security reasons.

We have developed ASTOR, a novel autostereoscopic optical see-through system for Augmented Reality [4] (See Figure 1). It uses a transparent *holographic optical element* (HOE) to separate the views produced by two, or more, digital projectors [2, 3]. Our minimally intrusive AR system does not require the user to wear special glasses or any other equipment thanks to the HOE.

THE AUTOSTEREOSCOPIC AR SYSTEM

We have demonstrated our system in a proof-of-concept setup on an industrial lathe (SMT Swedturn 300). The machine provides a rich set of measurement data that are critical to the work. The operators currently overlook the operation through a large safety window while a computer to the left of the machine provides measurement data and control. This setup forces the production engineers to divide their attention between the machine and the control computer in a disruptive way.

ASTOR replaces the separated display on the control computer with an intuitive 3D augmentation in the work space. The operators need only to look through the glass to see the measurements next to the relevant parts in 3D. Figure 2 shows how forces acting on the tip of the tool are visualized with component and resultant force vectors. The forces are updated in real-time and their location is accurately kept at the tip of the tool as it moves around.

The approach received enthusiastic responses from the operators and they enjoyed being able to monitor the values and the movement in the machine simultaneously.

Our ongoing work includes improving the display, extending it with eye tracking, investigating more advanced interaction techniques and exploring other applications.

This type of non-intrusive augmented reality can be useful in a wide range of scenarios, such as maintenance and repair, medical visualization, and various other types of annotation, as well as the presented control of complex industrial equipment.

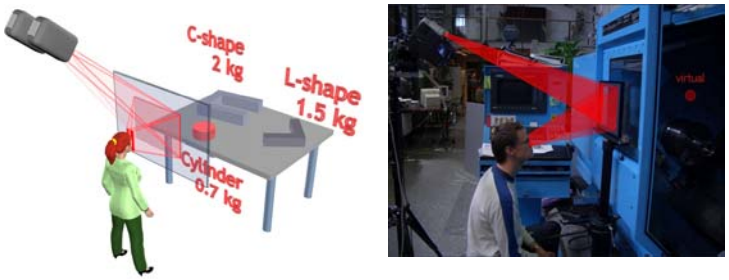

Figure 1. ASTOR uses a transparent HOE in the center of the larger window to separate the two projected views, such that each eye is presented with a different perspective, thus creating a stereoscopic effect. The red annotations and the cylinder represent virtual objects.

REFERENCES

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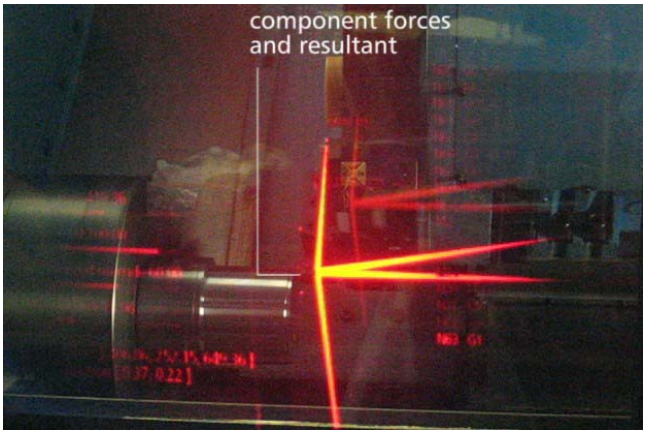

Figure 2. View through the display. Measurement data is updated in real-time and can be seen directly overlaid in 3D due to the autosteroscopic capabilities of the system.