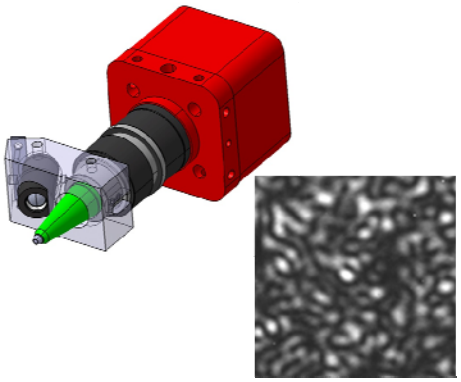

HIGH-ACCURACY LASER ENCODERS

A laser encoding technology, using the same principle as laser optical mice.

Project Summary

In the framework of this project, we studied the possibility to replace the expensive glass rules of classical optical encoders, with image correlation of speckle patterns. Indeed, a rough surface illuminated by a coherent wave will generate a random interference pattern, known as “speckle pattern”. When the device is moving on the target, the speckle pattern is moving. This principle is already well-known, and is the basic working principle of most laser optical mice. However, the limitations of such a technique have not been investigated so far. In this project, we used a theoretical model, which allows simulating speckle pattern in an imaging system and its detection by an image sensor with a limited number of pixels. This simulation tool is based on the Fourier Optics theory. Experimental tests show a very good agreement between simulations and experiments.

We have demonstrated experimentally and theoretically that sub-micrometer displacement resolution is possible by means of the cross-correlation of speckle patterns, over a range limited to half of the field-of-view of the imaging system. Two-dimensional cross-correlation algorithms have been also investigated, in order to enable frame rates > 300 images/second.

Valorisation

The results of this work have been presented at a SPIE conference, Optical Metrology, in June 2011 at Munich. A proceeding has been published recently. In addition, the project has been presented to an industrial partner. Because the technique is potentially low-cost, strong interest has been expressed by this potential industrial partner. A possible continuation of the project might take place in a few months, either in the framework of a CTI supported project or in the framework of a direct mandate.

Contact / Mr Y. Salvadé (yves.salvade@he-arc.ch)
Authors / Mr Y. Salvadé, R. Bonjour, V. Duay, F. Sauser, S. Bourquin

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