Fraunhofer IOSB

FRAUNHOFER INSTITUTE OF OPTRONICS, SYSTEM TECHNOLOGIES AND IMAGE EXPLOITATION

1

1 *Original image (l) and optimized image (r) in a drinking water reservoir*

IMAGE PROCESSING FOR UNTERWATER APPLICATIONS »UNDERWATER VISION«

Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB
Fraunhoferstrasse 1
76131 Karlsruhe, Germany

Business Unit Automated Visual Inspection

Prof. Dr.-Ing. Thomas Rauschenbach
Phone +49 3677 461 124
thomas.rauschenbach@iosb.fraunhofer.de

Dr.-Ing. Michael Heizmann
Phone +49 721 6091 329
michael.heizmann@iosb.fraunhofer.de

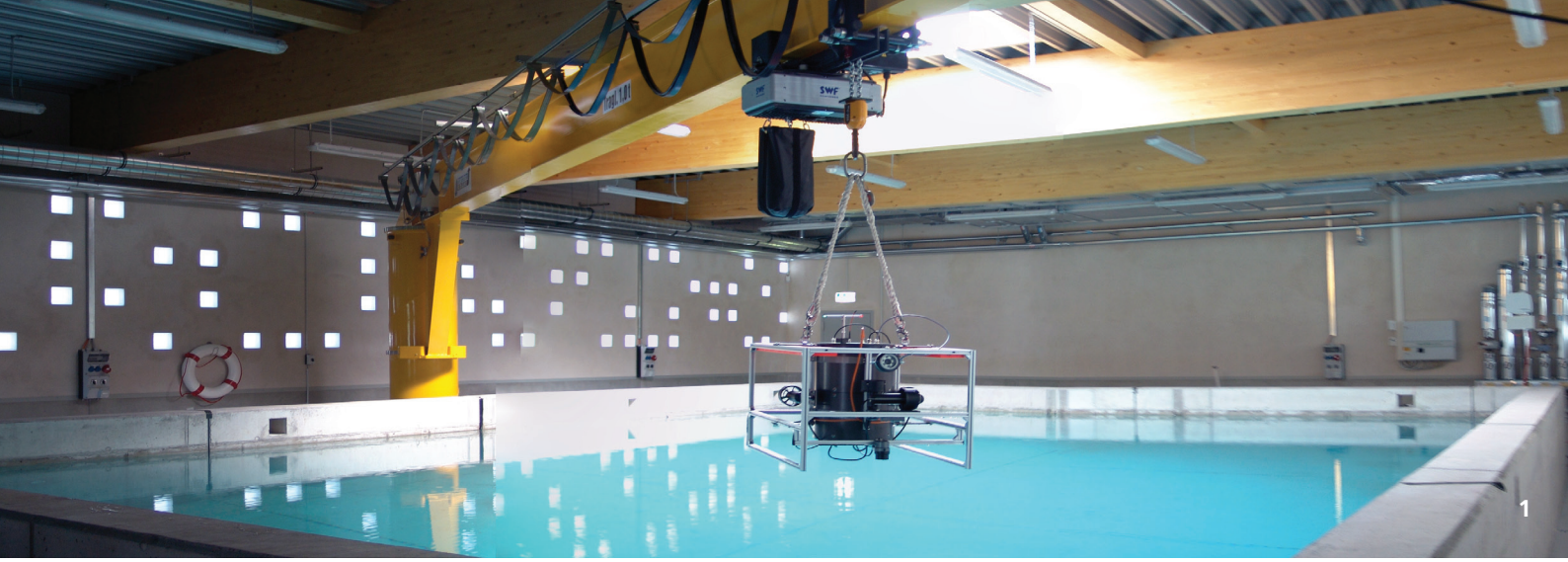
www.iosb.fraunhofer.de

Challenges

Offshore installations, drinking water reservoir and many other underwater infrastructure installations are typically only inspected visually or manually by divers. The disadvantages of this approach are known: it is dangerous, costly, time-consuming and yet does not often enable a full assessment.

In this area Fraunhofer IOSB offers methods and services around camera based inspection. Using cameras underwater poses major technological challenges. Currently used imaging methods are therefore mostly based on sonar sensors with advantageous characteristics for the medium water. However, these types of sensors have a significant disadvantage: The visual impression, the immense information content in texture and object reflectance as well as the possibility of an intuitive visual inspection by the expert becomes lost.

Using camera based imaging methods underwater on the other hand has many potential fields of application: the inspection of plants, seabed exploration, the search for wrecks up to the exploration of natural resources as e. g. manganese nodules. However, the use of cameras underwater brings also several technological challenges with the design of camera systems, lightings and image processing methods.



1

Methods

The components have to be selected and designed such that an optimal generation of images is possible despite water turbidity. Existing camera systems frequently fail as a result of poor visibility underwater arising from light scattering, light refraction, absorption, and floating particles. Besides the correct conception of components and their arrangement, it is therefore vital to create a sophisticated image enhancement and processing. For the use of camera systems in the underwater area, we offer various methods for the generation and processing of images:

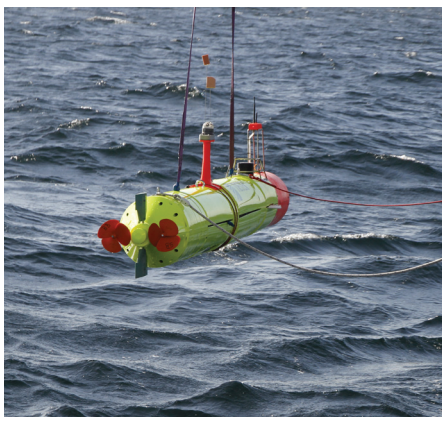
- Methods of image restoration to improve image quality and increase the visual significance of the image material
- Methods of variable lighting and image fusion to improve image quality
- Methods to create overview images (so-called image carpets) to ensure a complete inspection and to have a better overview
- Robust camera calibration tailored to the requirements in the underwater area
- Documentation and archiving of inspection results intended specifically for underwater inspection

For these methods, we offer consulting, theoretical and practical tests and studies as well as the development of procedures. We also support the implementation of these methods in real systems with further development, maintenance and training. Our partners and ourselves can refer to large experimental set-ups and vehicles for these tasks:

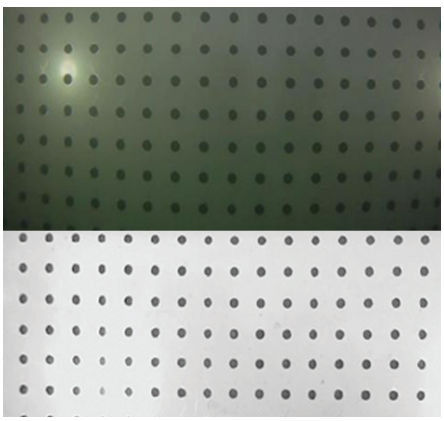
- Diverse commercial and experimental remotely operated vehicles (ROV) and autonomous underwater vehicles (AUV)
- Demonstrators for different test objects, as e. g. concrete walls and masonry
- Test beds for inspection and variable image acquisition

Customized Offers

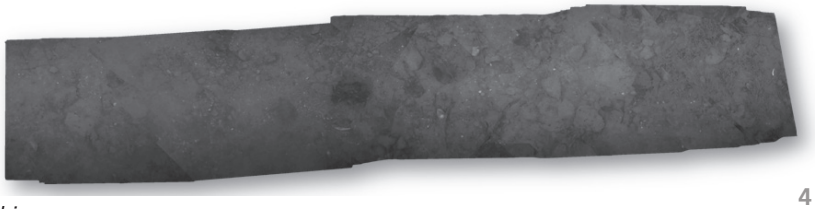
- Consulting services tailored to the actual task
- Inspection of underwater infrastructures with vehicle, stereo camera, lighting system and the gated viewing system LUCIE
- Use of test facilities and underwater test beds for the measurement and evaluation of sensors



2



3



4

1 *Research basin with experimental platform »ExAUV«*
2 *Research vehicle »TIETEK«*
3 *Robust camera calibration for applications underwater*
4 *Automated creation of image carpets by feature-based stitching*