

On the Potential of Range Imaging Cameras for Deformation Monitoring

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ABSTRACT:

Range imaging (RIM) cameras simultaneously acquire a grayscale and a distance image of the space projected onto the sensor. Currently, these cameras are in an early stage of development and only few products are available off-the-shelf. These products provide images of about 200x200 pixels, offer up to 50 frames per second and yield cm-level accuracies at distances of a few meters. However, the underlying physical principles and the rapid further development indicate that the performance limits have not nearly been reached yet.

Each individual frame of a range image represents a snapshot of the geometry of the surfaces mapped. The high spatial and temporal resolution along with the simultaneous acquisition of radiometric and geometric information renders RIM an attractive technology for deformation monitoring, in particular for structural monitoring.

We present experimental results from two bridges showing that vibrational modes with mm-level amplitudes can reliably be determined using a PMDTec Camcube 2.0. The noise at the level of the individual pixel and frame is successfully mitigated by filtering in time and space. We also discuss the current limitations and compare them to theoretical performance limits based on the underlying physical principles.