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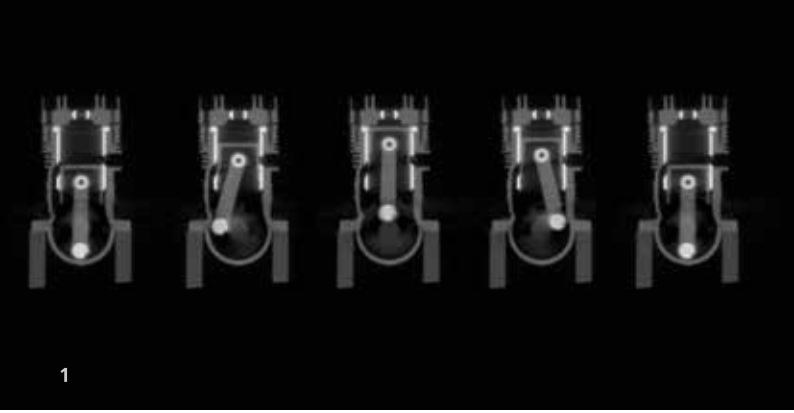
FRAUNHOFER INSTITUTE FOR
INTEGRATED CIRCUITS IIS
DEVELOPMENT CENTER X-RAY TECHNOLOGY EZRT

4D CT – TIME-RESOLVED COMPUTED TOMOGRAPHY



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Motivation

Traditional 2D or 3D computed tomography (CT) provides information about the geometry of a test object's hidden interior structures when in a static state. If the object under examination undergoes a dynamic change – such as movement due to physical or chemical processes, it is necessary to measure all of the relevant states to gain insight into the change. This can be accomplished only when the recording speed is higher than the observed process; this is rarely possible with conventional CT methods.

Time-resolved computed tomography (4D CT) allows you to capture, analyze and visualize the effects of time and other physical factors.

Function

A measurement using 4D CT is performed by taking several X-ray images in immediate succession. These are then reconstructed as a radiographic sequence or volume transmission and displayed. Radioscopy of a dynamic process involves a high-frequency scan from a suitable angle. To generate volume data, the process is carried out from various different directions. One way to achieve this is with help from a gantry scanning system that rotates around the object. Currently, processes can be captured three-dimensionally at a rate of less than one second per image.

A »MOVING LOOK« INSIDE

Benefits

- New insight into development of processes over time
- Non-contact measurements
- Measurement of motion-sensitive processes in situ

Areas of application with examples

- Quality assurance: load/stress tests, tensile and pressure tests
- Materials: material change in chemical reactor vessels under high temperature
- Chemistry: fluid kinematics in granulate
- Food research: development and decomposition of foams
- Automotive: action of complex mechanical processes (e.g. pistons, ball bearings)

1 *Sequence of slice images of the reconstruction of an engine piston*

03/14 M. Kostrubov

Fraunhofer Development Center
X-Ray Technology
a division of Fraunhofer Institute for
Integrated Circuits IIS
in cooperation with Fraunhofer IZFP

Director
Prof. Dr.-Ing. Albert Heuberger
Head of Division
Prof. Dr.-Ing. Randolf Hanke

Flugplatzstraße 75
90768 Fürth, Germany
info-ezrt@iis.fraunhofer.de

Contact
Michael Salamon
Phone +49 911 58061-7562
Fax +49 911 58061-7599
michael.salamon@iis.fraunhofer.de

Markus Eberhorn
Phone +49 911 58061-7525
Fax +49 911 58061-7599
markus.eberhorn@iis.fraunhofer.de

www.iis.fraunhofer.de/ezrt