3D scattering tensor based on one or two axes of rotation

Reference No: B76005

CHALLENGE

X-ray computed tomography (XCT) is a non-destructive evaluation method that is used to obtain high-resolution three-dimensional images of the internal structure of specimen. Advancements are being made for higher resolution XCT, however, there is always a tradeoff between the resolution and the size of the specimen that can be scanned. X-ray Tensor Tomography (XTT) (Malecki et al.) is a recent imaging modality that provides a solution to said trade-off. In contrast to conventional XCT where X-ray absorption is the main source of contrast, XTT utilizes the scattering of X-rays in order to analyze sub-micron sized structures inside macro-sized specimen.
Conventional **XTT-systems rely on three axes of rotation** in order to orient the specimen for image acquisition. To achieve this, the specimen stage needs to be positioned in an Eulerian cradle, enormously increasing the **system's complexity.** Additionally, this leads to a large set of image data resulting in an **extensive reconstruction process.**

INNOVATION

The present invention provides an XTT-system, which is capable of reconstructing sets of full 6D scattering tensors at each point in 3D space allowing the detection of inner specimen **structures having any orientation** by using only **one or two specimen rotational axes** (Sharma, APL).

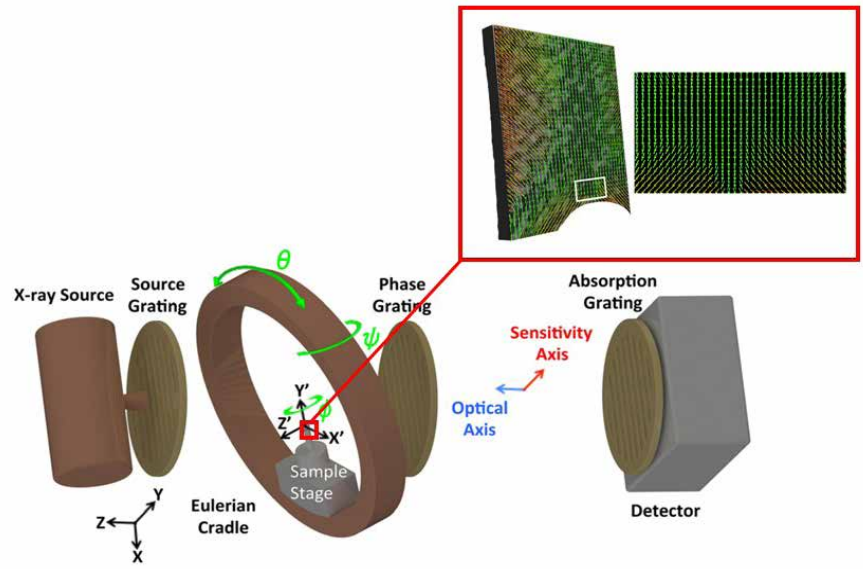

Figure: Setup and 3D-image of a Short Fiber Reinforced Polymer (SFRP) specimen made of glass fibers (18 µm in diameter). The color scheme is coded with the orientation of the fibres.

COMMERCIAL OPPORTUNITIES

The disclosed XTT-system provides more robustness and reliability and can be used for non-destructive material testing with several commercial advantages:

- **shorter acquisition time** caused by a smaller amount of specimen positions leading to a **faster reconstruction procedure** (Wieczorek et al.)
- **reduced costs and complexity** realized by a **simpler specimen stage** omitting the problematic rotation of the specimen due to between the gratings

DEVELOPMENT STATUS

Feasibility has been shown.

REFERENCES:

1. WO 2017/216178
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3. Sharma, Y., Wieczorek, M., Schaff, F., Seyyedi, S., Prade, F., Pfeiffer, F., and Lasser, T. (2016). Six dimensional x-ray tensor tomography with a compact laboratory setup. Applied Physics Letters, 109(13):134102.

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