Investigation of the shape-changing property of X-ray computed tomography in the evaluation of pores.

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Porosity in additive manufacturing is one of the main quality characteristics for components. In processes such as laser-based powder bed fusion of metals (LPBF-M), correlations can be observed between the process parameters used, such as laser power, hatch distance or layer thickness, and the pore shape produced. Therefor the surface depending criterion sphericity is a crucial parameter for the classification of pores. In addition to methods like micrographs or Archimedes' density determination, industrial X-ray computed tomography (CT) is a key measurement method for the spatial but also shape-dependent assessment of pores in components. However, due to the lack of standards, no measurement uncertainty for shape, position, and volume can be given for CT measurements. With the help of CT simulations and models for detector and X-ray source to real CT system, investigations can be made on the dependencies and influence on the detectability of pores. This study shows that the CT measurements as well as the analysis have an influence on the detectable volume and surface of pores. By modelling pore models with cosine periodic spatial frequencies (peaks), the spatial influence of CT on detectability can be investigated and assessed as a form of slope distribution. The simulation-based measurement uncertainty information can be used to improve the separation of pore shape classifications and thus contribute to the development of additive manufacturing.