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Recent Utilization of μfocus X-Ray CT for Voids Space Evaluation in Geo-materials

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Physical properties in rock are depending strongly on existence of voids space in rock. Quantification of total porosity and pore size distribution in rock can be done with Mercury Intrusion Porosimetry, but geometrical and spatial information in voids space are not obtained. It is well known that X-Ray CT is a good visualization tool as non-destructive and non-contact examination.We have introduced micro focus X-ray CT with high resolution of 10 micron to visualize and measure the voids space information in sandstone. We can get three-dimensional data simultaneously in the intact and stressed sandstone, pore structures and grain boundaries are distinguished well, pore closure and grain movement also are recognized well with increasing confining pressure. In addition, we introduced the three-dimensional medial axis (3DMA) method to quantify the flow-relevant geometric properties of the voids structure in sandstone using micro focus X-Ray CT data. The number of connecting path between two faces, tortuosity and the shortest path distribution within an arbitrary region of sandstone specimen were analyzed. Geometrical information on the number of connecting path in an arbitrary volume CT data shows reasonable correlation between permeability anisotropy observed by laboratory permeability test and mutually perpendicular directions normal and parallel to bedding planes.In this paper, we introduce geometrical information on voids connectivity, tortuosity distribution, shortest path distribution, and spatial distribution on a variety of voids size as well as permeability measurement as bulk estimation in rock specimen. Relative correlations geometrical information on voids space and permeability anisotropy are discussed.