# Study on packing structure of 3-D irregularly-shaped grains

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Geotechnical engineering, powder engineering etc. deal with an assembly of grains of irregular shape. Though it is well known that the grain-shape property greatly affects overall mechanical behavior of the assembly, its mechanism is still unclear. Since a granular assembly stands against an external force by constructing a contact-force network, it is essential to understand and measure the packing structure (number of contact points, their orientation etc.) inside the 3-D assembly.

In this research, several standard sands in the world that have different grain property are packed in various porosities, and measure their packing structures by using micro X-ray CT system (SP-μCT) at BL20B2. Owing to its high spatial resolution of about 13μm, the obtained re-constructed image as shown in Fig.1 is quite clear and the porosity can be computed with a sufficient accuracy. On the other hands, some additional efforts are required to obtain correct information on each grain shape and contact point. Fig.2 is a result of edge detection process, which shows some grains connecting with each other via contact points. Therefore, we are now developing a new efficient algorithm to automatically detect such contact points based on a edge shape analysis together with the CT-value distribution. Finally, compilation of such cross-sectional data enables us to obtain 3-D packing structure (Fig.3), which is quite valuable information in studying granular mechanics.

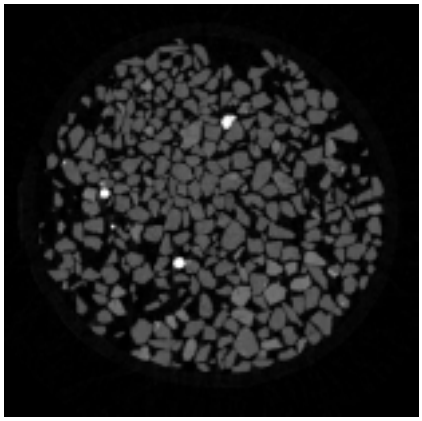

Fig.1 Reconstructed cross-sectional image (Toyoura sand, grain size ranges 0.1-0.2mm)

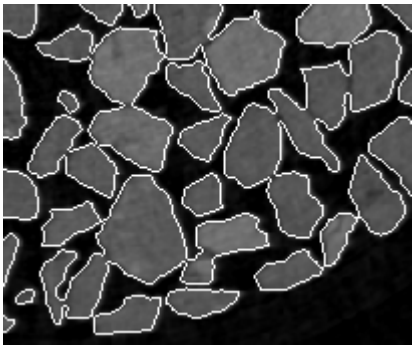

Fig.2 A result of edge detection scheme

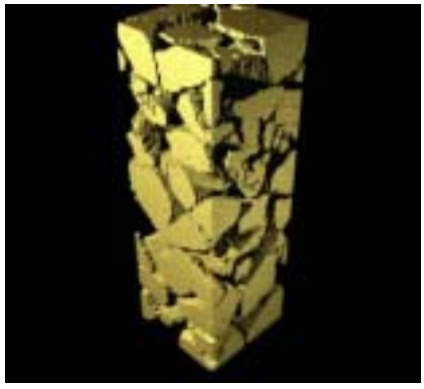

Fig.3 3-D packing structure (a part)