Visualization and numerical analysis for pore fluid behavior in granular material

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Pore fluid behavior is widely related to not only geo-science but also
various engineering problems.
It is substantially difficult to observe the internal pore fluid behavior,
and few visualization techniques are applicable including X-ray CT and MRI.
This paper deals with LAT-PIV (Laser-Aided Tomography and Particle Image velocimetry)
to visualize such grain-pore fluid interaction.
LAT was originally developed to visualize the interior of 3-D granular assembly,
in which the glass grains is submerged into a liquid whose refractive index is
the same as that of the glass. A laser light sheet is then passed through the model,
which makes the contour of the grains illuminated within the optically cut cross section.
In the present study, small amount of fluorescence powders are mixed
in the liquid to observe the motion of liquid.
The fluorescence powders are illuminated in a different color from
the grain contours, which enables us to observe the motion of grains and
liquid independently.
Then, permeability and boiling tests were performed to validate the technique.
The distribution of the pore fluid velocity was measured successfully
by the technique and an image processing.
As a result, it is derived that the distribution is not
the Gaussian distribution but the log-normal distribution.