VOID DISTRIBUTION IN GRANULAR MATERIAL DURING SHEARING PROCESS

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During shearing process, it has been observed that particle arrangement in granular material such as soils is continuously changing following friction and dilatancy law. In this case, void distribution in the granular material seems to be very important to realize the deformation and strength mechanism. The author, therefore, forcuses his much attention on the local void distribution in the granular material.

In this investigation, using photoelastic pictures of model granular matetial under simple shear condition, the distribution feature of local voids is studied. The following parameters are obtained experimentally;

N : Total number of local voids in granular material
V_s: Total volume of solid particles in granular material
V_i: Volume of i-th void
e_i: Local void ratio($= V_i/V_s$)
$\bar{e}_i$: Average local void ratio($=\sum e_i/N$)
s : Standard deviation of local void ratio($= \sqrt{\dfrac{\sum (e_i - \bar{e}_i)^2}{N}}$)
n_j: Number of local void ratio vs void largeness
p_j: Probability density($=n_j/N$)
H : Entropy($= -\sum p_j \log_e p_j$)

The remarkable results found out in this study can be summarized as

(1) The maximum value of N is corresponding to the most compactive point (the point C in Fig.2), and the number N drops sharply in the post peak stage. This may present a fundamental evidence to understand the softening mechanism of granular materials during shearing process.

(2) The initial smaller local voids developed in the hardening stage considerably disappear in the post peak stage. Thus the distribution of local voids becomes flatter with shearing in the post peak. This may indicate it possible that the various sizes of local voids occupy the void spaces in this post peak stage.

(3) The entropy H increases monotoneously and has a unique relationship with the average void ratio $\bar{e}_i$. This finding shows that the dilative deformation is always associated with the entropy production.

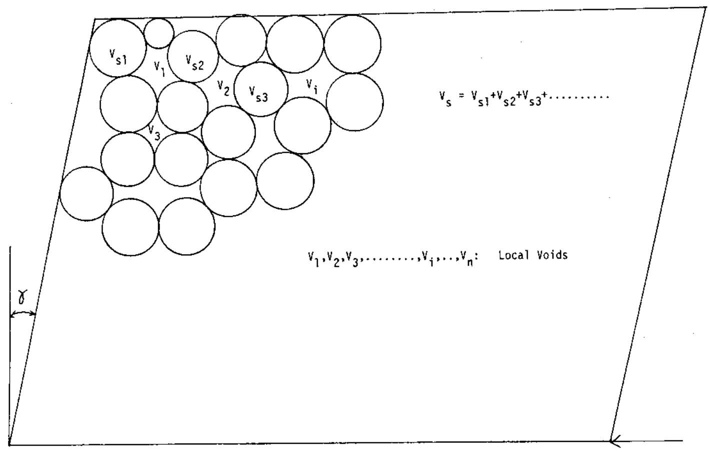

Fig.1

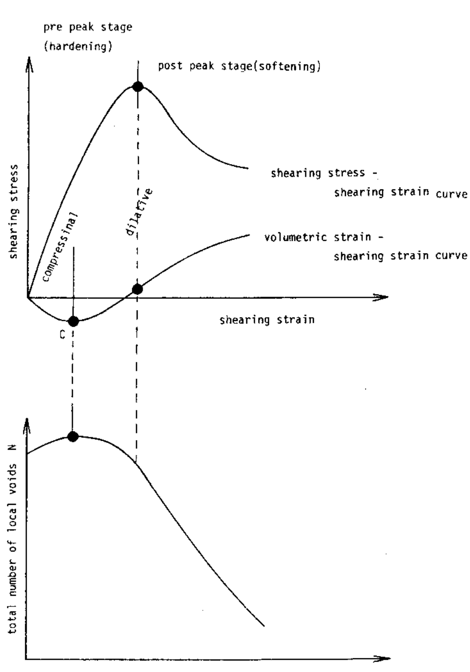

Fig. 2

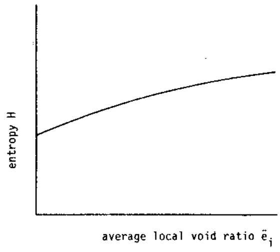

Fig.3

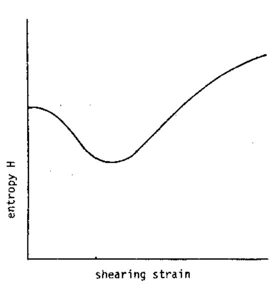

Fig.4

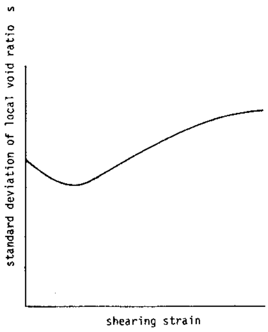

Fig.5