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assessment of some granular mixture

ONLINE SUPPLEMENT: EXAMPLE GRADING ENTROPY CALCULATION

Table S1 gives an approximate interpolation example to convert a particle size distribution (PSD) from British standard sieves to ASTM standard sieves. For some mixtures, the upper bound and lower bound of particle size must be extended to fit the required geometric progression and thus may introduce some slight skewness in the gradation curves. The interpolation can also be applied to any arbitrary sieve sizes to aid the grading entropy calculation. With more accessible PSD information, the accuracy of the interpolation may improve.

Table S1: Approximate data interpolation between BSI (1990) and ASTM (2017) sieves

BSI (1990) sieves		ASTM (2017) sieves	
Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
0.063	0.001	0.075	0.0012
0.15	0.0027	0.15	0.0027
0.3	0.0063	0.3	0.0063
0.425	0.0075	0.6	0.0135
0.6	0.0135	1.18	0.0275
1.18	0.0275	2.36	0.0669
3.35	0.1	4.75	11.21
6.3	23.5	9.5	55.29
14	100	19	100

Table S2 shows the calculation process for A and B using the interpolated PSD from Table S1.

Table S2: Calculation example for A and B

Sieve Size (mm)	% Passing	Fraction no. (refer as i)	x_i	$x_i(i-1)$	$x_i \log_2 x_i$
0.0375	0	0	0		
0.075	0.0012	1	0.000012	0	-0.00020
0.15	0.0027	2	0.000015	0.000015	-0.00024
0.3	0.0063	3	0.000036	0.000072	-0.00053
0.6	0.0135	4	0.000072	0.000216	-0.00099
1.18	0.0275	5	0.00014	0.00056	-0.00179
2.36	0.0669	6	0.000394	0.00197	-0.00446
4.75	11.21	7	0.111431	0.668586	-0.35277
9.5	55.29	8	0.4408	3.0856	-0.52094
19	100	9	0.4471	3.5768	-0.51923
			SUM	$\sum_{i=1}^N x_i(i-1)$	$\sum_{i=1}^N x_i \log_2 x_i$
				7.333819	-1.4011428

where x_i is the relative frequency of fraction i , which is %Retained divided by 100.

Thus, the corresponding normalized entropy coordinates can be calculated as:

$$A = \frac{\sum_{i=1}^N x_i(i-1)}{N-1} = \frac{7.3338}{8} = 0.9167 \quad (\text{Equation S1})$$

$$B = -\frac{\sum_{i=1}^N x_i \log_2 x_i}{\log N} = \frac{1.4011}{2.1972} = 0.6377 \quad (\text{Equation S2})$$

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