Parameters used in the LS-DEM simulations:

1. Surface discretization parameter: 0.06 [mm]
2. Volume grid spacing: 0.025 [mm]
3. coefficient of restitution: 0.5 []
4. coefficient of global damping: 10 [1/sec]
5. number of time steps for relaxation: 1,000,000
6. number of time steps for puncture: 5,000,000
7. k_n=500,000 GPa/mm (representing E=4.2 MPa)
8. k_n=1,000,000 GPa/mm (representing E=8.4 MPa)
9. critical time step calculated as: dt = 0.01*sqrt(.4*minMass/kn), where minMass is the mass of the smallest block

General explanation of data files whose name starts with ‘positions’ or ‘rotations’ and which refer to figures showing snapshots of the deformed topologically interlocked assembly (Figures 5, 6, 8, 9)

In files whose name starts with ‘positions’ or ‘rotations’, e.g., positions_fig_5b_3x3.dat, the lines correspond to the positions/rotations of all the grains and the indenter at 101 representative time increments per simulation. For the 3x3 case, there is a total of 26 grains (25 grains + the indenter) and so each file contains either 2626 lines (101 snapshots times 26 grains per snapshot). For the 5x5 case, there is a total of 50 grains (49 grains + the indenter) and so each file contains either 5050 lines (101 snapshots times 50 grains per snapshot). For the 7x7 case, there is a total of 82 grains (81 grains + the indenter) and so each file contains either 8282 lines (101 snapshots times 82 grains per snapshot).

The organisation of the lines is by groups of increments. For example, for a 5x5 assembly the lines are organized as:

Line 1 refers to grain 1 at time increment 1/101
Line 2 refers to grain 2 at time increment 1/101
Line 3 refers to grain 3 at time increment 1/101
...
Line 49 refers to grain 49 at time increment 1/101
Line 50 refers to the indenter at time increment 1/101
Line 51 refers to grain 1 at time increment 2/101
Line 52 refers to grain 2 at time increment 2/101
Line 53 refers to grain 3 at time increment 2/101
...
Line 99 refers to grain 49 at time increment 2/101
Line 100 refers to the indenter at time increment 2/101
...

and similarly for the 3x3 and 7x7.

In the ‘positions’ files, columns 1, 2, 3 refer to the x, y, z cartesian components.
In the ‘rotations’ files, columns 1, 2, 3, 4 refer to the components of the unit quaternions indicating the orientation of the grains.

General explanations concerning files that contain data on the contact forces between the grains (files whose name start with ‘contact_forces_’)

The first two columns contain the indices of the grains in contact. Columns 3-5 contain, respectively, the x, y, and z components of the contact force [N]. The last three columns contain, respectively, the x, y, and z components of the position of the point of application of the contact force. The indices of the blocks are organized from bottom-to-top and left-to-right. For example, for a 3x3 assembly they are:

42			...			48
35			...			41
28			...			34
21			...			27
14			...			20
7	8	9	10	11	12	13
0	1	2	3	4	5	6

Explanation of load-deflection data files referring to Figure 5

In the files referring to Fig. 5a (load-deflection curves data), the left column contains deflections in [mm] and the right column containes loads in [N]. Note: The FEM and LS-DEM loads in the raw data are not normalized by the experimental peak loads, as they are in Figure 5 in the paper.

Explanation of load-deflection data files referring to Figure 6

In the files referring to load-deflection curves, the left column contains deflections in [mm]. Column 2-5 containes loads in [N] for the values of k_n^gaps = 0.49, 0.65, 1.01, and 1.5 [GPa/mm], respectively.

Explanation of load-deflection data files referring to Figure 7

The first column in LSDEM_load_deflection.txt contains the deflections. Columns 2-10 contain the loads for FIg. 7(a-i), respectively. For the experimental results, the left column contains deflections and the right one loads.

Explanation of load-deflection data files referring to Figure 9

In the files referring to load-deflection curves, the left column contains deflections in [mm]. Column 2-4 containes loads in [N] for the values of Mu = 0.23, 0.21, and 0.19, respectively.