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Discussions

Interactive comment on "Effects of the impact angle on the coefficient of restitution based on a medium-scale laboratory test" *by* Yanhai Wang et al.

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This is a good set of experiments. I encourage the authors to take some time to improve their manuscript. Here some comments that can be useful.

LINE 4 PAGE 4. Please note that this RE value omits the rotational kinetic energy and as such, it simplifies the description of the collisions. I do expect that your spherical polyhedrons rotated both before and after their impacts. This should be mentioned in the discussion since it affects the plot in Fig 8. For example, in our experiments (Cagnoli and Manga, 2003), our cylindrical particles did have a rotational kinetic energy but only after the collision with the target as the high-speed video camera confirmed.

LINE 18 PAGE 5. I think that a drawing of the apparatus with vertical and horizontal length scales would improve the readability of the paper.

FIG 8 PAG 11. Here, it seems to me that you felt the obligation to have to find one single best-fit curve even if your data points illustrate a much more complex situation. Rather than concave-down best-fit curves (which are truly not convincing), this plot shows two features: 1) the maximum values decrease as the impact angle increases and 2) the spread of the data points decreases as the impact angle increases. This is true for both your grain sizes. We obtained these same features as shown by Fig 4A in Cagnoli and Manga (2003). I strongly suggest to remove these concave-down curves because they are truly misleading.

FIG 9 PAG 11. It would be useful to identify in this figure each experiment with its own characteristics.

TABLE 2 PAG 13. Please note that our cylinders are 0.89 cm long and with a basal diameter equal to 0.55 cm (Cagnoli and Manga, 2003). However, rebound angles of larger cylinders are also shown in Fig. 2A.

LINE 9 PAG 13. The rebound angles can be larger than the impact angles for two reasons. First, the surface of your concrete slabs cannot be perfectly flat in particular after the target has been damaged by previous impacts. Second, the surface of your particles has a curvature that varies from place to place (i.e., they have edges and corners). In other words, the true impact angle is not known. In our Fig 2A, some rebound angles are also larger than the impact angles. Even if this seems to be a flaw of the experiments, it has to be accepted as the inevitable complexity of rock fragment collisions and it is still useful to understand this complexity. For this reason, it is not correct to exclude what you call "non-ideal data points" when computing best-fit curves. The truth is that a single best-fit curve of the entire set of data points in Fig 8 does not exist. You can plot only a trend line for the maximum values if you really want to.

FIG 11 PAG 14. Please, remove curves 5 from Figs 11a, 11b and 11c, because, in nature, beta can be larger than alpha. Do Figs 11a and 11b display mean values? If yes, state this clearly. In Figure 11c, draw only curves showing the maximum RE values.

LINE 3 PAG 15. What you say here is true. However, I would rephrase the sentences. The small Rn values in Cagnoli and Manga (2003) are due to the weak strength of pumice whose damage upon impact dissipates energy.

LINE 25 PAG 15. What do you mean with “nadir”? Please find a more appropriate word.

LINE 30 PAG 15. As explained above, curve 1 in Fig 11c is not useful and should be removed from the plot.

LINE 8 PAGE 16. This is not correct. Both your Fig 7 and our Fig 3B confirm that Rt increases as the impact angle increases. The problem is that the data spread is large. But this is due also to irregularity on the surfaces of target and particles, for example.

LINE 21 PAGE 16. This is the same explanation we have provided in our paper (see our Fig 1), but no credit is given.

LINE 18 PAGE 18. The use of the coefficient of restitution does not provide a good description of rock fragment collisions. But credit should be given to who has already said it (e.g., Stronge, 1991). Both your and our data sets show that: 1) there is no such as thing as a single value of the coefficient of restitution, and 2) also the more informative ratio of the kinetic energy is not a constant.

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