Comment on gmd-2021-200

Anonymous Referee #1

Referee comment on "An explicit GPU-based material point method solver for elastoplastic problems (ep2-3De v1.0)" by Emmanuel Wyser et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-200-RC1, 2021

The authors implemented an explicit GPU-based solver within the material point method framework and tested using two- and three-dimensional problems. Results seem to agree with the expected values validating this MPM - GPU architecture. I would like to suggest the publication of this work. Nonetheless, some minor points should be addressed first.

- The authors mentioned that this GPU architecture speeds up information transfer between nodes and material points. As stated, this is one of the most computationally expensive operations in MPM. Nevertheless, finding material points new location after the mesh returns to its original position is another process that is computationally expensive (in many cases more expensive than information transfer between nodes and material points). I would like to know if the GPU architecture proposed also improves this step. If yes, the author could indicate it in the paper. If not, it would be interesting if the author discusses the possibility of combining some techniques (e.g. Pruijn N.S. 2016) together with GPU's to improve MPM computations.

Pruijn N.S. 2016. The improvement of the material point method by increasing efficiency and accuracy. TU Delft Master Thesis.

- The authors include a damping value D in the simulations. This value is not well validated. It seems that several simulations were needed to find it, giving the idea that D is not related to the material properties and geometry and is more of an artificial way to reach the desirable results. The authors should elaborate better on the reasons for using this specific damping value.

Besides the previous comments, other minor issues should be reviewed.

- In line 32, the authors mentioned that "The background mesh can be reset". As far as I know, the background mesh must be reset. I recommend changing the verb "can" for a better one.
- I am wondering if the variables in line 75 are the same as in equations 2 and 3 since different punctuations were used (e.g. Å« and û).
- Finally, I recommend reading the paper again to correct some typos detected.