**For research article**

Parametric modeling and numerical simulation of three-dimensional random aggregate model of lime sand pile based on Python-Abaqus

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| Response to Reviewer 3 Comments | | |
| **1. Summary** |  |  |
| Thank you very much for taking the time to review this manuscript. Please find the detailed responses below and the corresponding revisions/corrections highlighted/in track changes in the re-submitted files. | | |
| **2. Questions for General Evaluation** | **Reviewer’s Evaluation** | **Response and Revisions** |
| Does the introduction provide sufficient background and include all relevant references? | Can be improved |  |
| Are all the cited references relevant to the research? | Can be improved |  |
| Is the research design appropriate? | Can be improved |  |
| Are the methods adequately described? | Can be improved |  |
| Are the results clearly presented? | Can be improved |  |
| Are the conclusions supported by the results? | Can be improved |  |
| **3. Point-by-point response to Comments and Suggestions for Authors** | | |
| **Comments 1:** The manuscript needs revisiting regarding style/rigor of writing, typos, grammatical errors, etc. Please have a native English speaker proofread the manuscript before re-submission. | | |
| **Response 1**: Thank you for pointing this out. I agree with this comment. Therefore, I corrected these writing style, language, grammar and spelling mistakes and asked native English speakers to proofread the manuscripts. | | |
| **Comments 2:** The whole manuscript needs to be carefully checked for proper references. Some relevant studies and mentioned states need to be included. The authors are requested to check relevant literature and update it. | | |
| **Response 2:** Thank you for pointing this out. I agree with this comment. I have fully checked the manuscript and rewritten the introduction and added the appropriate references. See the reference section of the new manuscript for details.  **Comments 3:** Please clarify and highlight this research's original main idea and novelty compared to previous studies.  **Response 3:** Thank you for pointing this out. The novelty of this paper is that there is no research on the meso level of lime sand pile material at home and abroad, and there is no numerical simulation for lime sand pile material. Therefore, this paper creatively puts forward the modeling method of random spherical aggregate of lime sand pile and verifies it. Secondly, the calibration of mesoscopic parameters reflecting the overall mechanical properties of composite materials is a difficult point in this paper. The innovation points are also mentioned in the text, as shown in lines 63-68 of the new manuscript (marked in red).  **Comments 4:** Some references need to be written in a unified form.  **Response 4:** Thank you for pointing this out. I agree with this comment. I have carefully read the requirements of the journal, and have made a uniform format correction for all references cited.  **Comments 5:** There are some new studies on the same topic, considering the keywords the authors may have missed, which might be beneficial to mention in the introduction for the sake of the article's completeness. These new studies would show the manuscript's relevance to this journal, and hence, the authors are strongly recommended to address any available relevant articles.  **Response 5:** Thank you for pointing this out. I agree with this comment. I have carefully consulted the latest literature in related fields such as microscopic simulation, gray sand pile material research, and secondary development of abaqus, and have made reasonable references and updated the references.  **Comments 6:** The abstract should be modified, and quantitative details about the research results should be presented.  **Response 6:** Thank you for pointing this out. I agree with this comment. Therefore, I modified the abstract part and added a lot of simulated quantitative detail analysis later. According to your opinion, see the new manuscript 19-28 lines (marked in red).  **Comments 7:** The limitations of the present study should be clearly stated.  **Response 7:** Thank you for pointing this out. I agree with this comment. This study is based on laboratory experiments. The microscopic RVE model of lime sand pile is verified by the data collected from the test. After verifying the validity of the model, the size pile used in practical engineering can be simulated through cross-scale research. At that time, the support of supercomputers may be needed, and the current research methods cannot meet the requirements of supercomputing. This is the limitation of this study, which is also supplemented in the follow-up research plan of the article. See lines 500-508 of the new manuscript (marked in red).  **Comments 8:** It is critical to validate the results against observations. Through this way, one could know the validity of the models. In my view, the authors should add more detail to the validation section, and verification needs deeper interpretation.  **Response 8:** Thank you for pointing this out. I agree with this comment. The validity of the model is verified by the output of the simulation results and the comparison with the experimental data. However, there are too few explanations for these conclusions, so I added a lot of analysis processes for the simulation results in the article. For details, please see the new manuscript 413-418 and 463-465 lines (marked in red).  **Comments 9:** What distinguishes this study from others that have been published in the scholarly literature? As there are numerous other studies in the body of research that are comparable to these studies, kindly compare them. Write out the similarities and differences, with an emphasis on your uniqueness. It is crucial to emphasize in the beginning how special this piece of study is.  **Response 9:** Thank you for your question. Most of the literatures mentioned in this paper are aimed at the meso-level research of concrete materials, and this paper verifies that the method is also applicable to the composite material of lime sand pile through the delivery test, and completes the construction of the meso-model. The same as the latest research, the modeling method I used is a continuation of previous research. The difference is that I need to simulate the microscopic parameters that meet the overall performance of the composite material and perform calibration verification, which is different from its direct input constitutive model. According to your opinion, I have put the innovation points in the front part of the article, as shown in lines 63-68 of the new draft (marked in red).  **Comments 10:** The paper does not present a high level of innovation. Justify this matter. The novel contributions of this study are not addressed well in the manuscript. It is required to be reorganized in order to become more apparent. The authors must emphasize the novelty of their research and that their work can be successfully used in other regions and settings because this justifies the publication in an international journal.  **Response 10:** Thank you for pointing this out. I agree with this comment.This paper is based on the existing material simulation research of lime sand pile, but this research has certain innovation, such as the following points : 1.This research fills the blank of meso simulation of lime sand pile material ; the lime-sand pile material is widely used in the reinforcement of collapsible loess foundation in Northwest China, Central Asia, Central Europe and other countries, as well as the reinforcement of plateau frozen soil foundation, the numerical simulation can be used to guide engineering practice. According to your suggestion, I will study the purpose of a single section are discussed, added the contribution of this study, and studied the lime sand pile material suitable area and environment, the details can be seen in the new manuscript 45-52 (marked in red) and 1.2 section.  **Comments 11:** The introduction is general. It is desired to rephrase this part to emphasize the objective of the study. In this reviewer's opinion, the introduction should be rewritten and extended with more new refs.  **Response 11:** Thank you for pointing this out. I agree with this comment. According to your opinion, I re-planned and rewritten the introduction of the paper and added some new references.  **Comments 12:** The manuscript requires some language corrections to avoid editorial errors and also needs the edition for proper English language, grammar, punctuation, spelling, and overall style. It's recommended that it be checked by a native person.  **Response 12:** Thank you for pointing this out. I agree with this comment. Therefore, I have corrected these language, grammar and spelling errors and asked native English speakers to proofread the manuscripts.  **Comments 13:** The authors should improve discussion sections. Clearer presentation and discussion of the results should be provided. The reported claims should be adequately discussed in the context of the literature.  **Response 13:** Thank you for pointing this out. I agree with this comment. Therefore, I have made a lot of changes to the conclusion part of the article, writing more concisely, deleting those parts that are well known to researchers and designers, and having a full discussion, please see the new manuscript 471-481 lines (marked in red)  **Comments 14:** Although the paper's objectives are mentioned in the introduction, additional information is provided, making it difficult to comprehend these objectives. The aim should be uniquely stated, and then the importance should be appreciated by those who are interested in this paper. I suggest splitting this part into two paragraphs or numbering the objectives in order to be clear. Please apply.  **Response 14:** Thank you for pointing this out. I agree with this comment. According to your suggestion, I will delete all the useless parts of the introduction in order to facilitate the readers to understand, and write the introduction in sections, which strengthens the research purpose of the article. For details, please see the introduction part of the paper.  **Comments 15:** I have not any sense of numerical simulation. Therefore, it is critical to the authors send me main of the numerical modeling file to modeling be checked. Otherwise, I can not accept this resaerch work. The authors can send numerical simulation by: https://github.com/.... Or other methods.  **Response 15:** Thank you for pointing this out. I have added many new contents in the numerical simulation part, such as boundary conditions and constraints, the number of grid elements, the reason of selecting element type, the result analysis and so on. The simulation in this paper is a static analysis process, so it looks relatively simple, but the setting of mesoscopic parameters is very complicated. The quality of mesh division and whether it can be calculated normally are very complicated, and the calculation time of a single model is very long, generally 3-4 hours. It is very time-consuming to carry out multi-group and multi-times repeated comparative simulation of controlled trials. In order to dispel your doubts, I have provided you with a classic and effective abaqus.cae / .inp file, which is a mix ratio of 5 : 4 : 1, which is convenient for you to view the model and file information. You can also view the results through the .inp file for effective trial calculation.  The file was too large to upload in GitHub, so I had to send the .inp file at this link: <https://github.com/renfengyuzhong/review3.git>  **Comments 16:** Insert Notations before abstract.  **Response 16:** Thank you for pointing this out. I read the journal requirements and read the journal articles. The annotations are often used to explain the specifications, formulas, etc. The journal does not require annotations before the abstract. Thank you again for your comments.  **Comments 17:**The author shuold add more explanations related software and modeling .The authors said almost nothing on the modeling. A sketch including the information of the arrangement of meshes, the boundary conditions and the number of elements,.... should be presented for a better readability.The following studies be mentioned to enhance the impact of the article for numerical modeling:  https://doi.org/10.1007/s40808-022-01543-y; https://doi.org/10.1007/s41062-022-00861-5  **Response 17:** Thank you for pointing this out. The introduction of software and modeling has been discussed in the first two chapters. According to your suggestion, I added the details and selection reasons of meshing, the statistical table of the number of grid units, the setting of boundary conditions and constraints, and the interpretation and setting of the temperature load curve in the simulation part. For details, please see the new manuscript 338-342, 352-357, 387-396 lines (marked in red). I seriously refer to the literature you recommend, because this article is a static analysis simulation of the meso level of the material, the content and theme of the literature are not very suitable for this article and should not be cited. But thank you for your recommendation and a lot of guidance for my article.  **Comments 18:** The authors should show used mesing in the numerical simulation in a separate figure.  **Response 18:** Thank you for pointing this out. I agree with this comment. Therefore, I have separately discussed the grid division, added the grid division map, and counted the information of the grid division unit. For details, please see lines 338-342, 352-357 (marked in red).  **Comments 19:** Insert refs for all of the used numerical software in ref sections.  **Response 19:** Thank you for pointing this out. I agree with this comment. Therefore, I have added references mentioned in the introduction to the references, and many references that are helpful to me in the numerical simulation process. Details can be viewed in the reference section of the article.  **Comments 20:** All of the equations and parameters should be checked again.  **Response 20:** Thank you for your reminder, I have checked the formulas and parameters in the paper and corrected the correct format.  **Comments 21:** All of the parameters in text, figures, and tables, ... should be in italics. Check all of the parameters.  **Response 21:** Thank you for your reminder, I have checked the parameters in the paper text, charts and put them in italics.  **Comments 22:** References, Figures, and Tables should be listed in the order in which they are mentioned in the text.  **Response 22:** Thank you for your reminder, I have checked the sorting of pictures and tables to confirm that it is correct, and the order of references is also consistent with the citation in the article.  **Comments 23:** Conclusions sections should be re-arranged as Conclusion and Recommendations.  **Response 23:** Thank you for pointing this out. I agree with this comment. Therefore, I changed the conclusion and suggestion. At the end of the paper, I put forward many topics that can be studied and considered in the future, and put forward some reasonable suggestions for the readers to study the material of lime sand pile. See the new manuscript 500-508 lines (marked in red).  **Comments 24:** The conclusions section is suggested to be written more concisely, especially, excluding those that have beenwell known to researchers and designers.  **Response 24:** Thank you for pointing this out. I agree with this comment. Therefore, I have simplified the conclusion and deleted the content that researchers and designers are familiar with, as shown in the new manuscript 471-481 lines (marked in red).  **Comments 25:** The references list is inconsistent and composed of several writing styles and punctuation errors, which is unacceptable. Rewrite all references according to the journal's format.  **Response 25:** Thank you for pointing this out. I have consulted the journal requirements and corrected the problems in the references.  **Comments 26:** I think in the section References the digital object identifiers (DOIs) are completely missing. Please insert them in cases of all references where the DOIs are available.  **Response 26:** Thank you for pointing this out. I agree with this comment. I have supplemented and added the DOI numbers of all the documents that can be found and correctly cited as much as I can. | | |
| **4. Response to Comments on the Quality of English Language** | | |
| **Point 1:** The quality of the English language is moderate. | | |
| **Response 1:** I have modified the language and grammar of the article, and also let the native English scholars to proofread. | | |