A novel multiscale modelling approach for evaluation of the ASR in concrete structures

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Responses to the Reviewer's Comments

Review by: Reviewer #1
Review date: Oct 9 2017 02:32 AM PDT

The review:
Thank you for this submission. It fits within the scope of ICDCS and the language is appropriate. I cannot gauge from the abstract the extent to which the model is validated by experimental data. You say that there is experimental validation, then talk about x-ray tomography. I assume from this that the tomography is not the experimental validation. I think that the links between your modelling and experimental validation should be strengthened, or at very least made more clear in the text.

Response: Thanks for this insightful comment. The last paragraph of the "microstructure with X-ray CT" was modified for more clarity.
Actually, X-Ray CT (XCT) is presented in this study as a supporting tool to better understand to what degree ASR has happened in the concrete sample. Herein, XCT is not a validation of the FEM model. This approach is under progress to be applied to a dam structure, and a core from the dam structure is going to be used for practical validation purpose. However, in the case of model development by fracture mechanics, the XCT images can be used more directly to validate crack initiation and propagation.

Review by: Reviewer #3
Review date: Mar 5 2018 11:12 AM PST

The review:
The manuscript is well written. However, there are some minor corrections which are given below:
1. Page 2, 2nd col, under subheading ANN Model,12th line, "was develop" is to be corrected as "was developed"
2. Page 4, 1st col, under subheading Summary of FE Model results, 5th line, "consider" to be corrected as "considered"
3. Table 2, first letter of the title should be in capital
4. Page 5, 2nd col, 2nd para, 4th line, "curved" is to be corrected as "curves"
5. Page 6, References 16, 18, 21 etc are not following the format.

All requested corrections were made.

The review:
1. In the section of ANN, what is MATLAM? You mean MATLAB, correct?
   a. Response: MATLAB was corrected in the text.
2. Models are ok. In the XCT tests, what are the dimension of specimen? Are they larger than REVs? And what is the resolution?
   a. Response: The size of the specimen was 1 x 2 in, which can be considered as RVE, as it includes one single aggregate in the cement paste. For the sample diameter between 1" to 2", we can get resolution (voxel size) between 30 to 55 micron.
3. Did you see cracks using XCT? Can your FEM simulate cracks?
   1. This study is still under progress. According to different studies, the cracks can form inside the aggregate and propagate into the paste, or they can form in ITZ, which depends on some parameters such as aggregate reactivity, strength of the binder, free or constrained expansion, etc. in this part of the study, one single reactive aggregate was used (to simulate RVE) and free expansion occurred. As a result, we could not see crack development in the images.
   The FEM presented in the paper was used for stress/strain analysis and expansion modeling. However, XFEM is going to be used for Crack propagation modeling as a part of this under-progress study.