

We thank the reviewer for their insight and useful comments on our manuscript. We made the required changes to the manuscript and you can find below our answer to the comments

Reviewer

In their revised version of the paper “Devito (v3.1.0): an embedded domain-specific language for finite differences and geophysical exploration” the authors have additional CFD-examples to emphasize the generality of their software. Additionally, they have fixed the minor issues that was raised in the first round of revisions.

I accept the authors argumentation for a self contained section about the implementation, and I am pleased to see that they now refer to their previously published work on the subject in The Leading Edge.

Technical corrections:

1. Page 3, Line 3: Missing space in the added “and computational fluid dynamics”.

- fixed

2. Page 20, Line 1: Missing space after `minConf_PQN`

- fixed

3. Page 20, Line 19: “Convection” should be non-capitalized.

- fixed

4. Figures 14-17, 20: Missing punctuation at the end of caption.

- fixed

Minor issues:

1. Page 20, Line 3: Doesn’t each iteration require a single PDE solve per source q_s ? Please rewrite this sentence to make it clearer.

- Each iteration does require two PDE solves not one as explained in the FWI section. A first one to model the synthetic data d_{syn} and the forward wavefield u_s , then a second one to solve the adjoint wave equation to compute the gradient. This is conventional adjoint state formulation that requires two PDE to compute the gradient. The sentence now refers to the theory section for clarity.

2. Page 20, Line 4: We can only afford a (10) ... is not a complete sentence. Please revise.

- Sentence is revised for clarity.

3. Page 21, Figure 14: Caption is a bit too short. I suggest adding a comment about the Dirichlet BCs, as they are not mentioned in the text.

- Caption extended with Dirichlet BC explanation.
4. Page 23, Figure 16: Caption is too short. I would add a comment regarding `first_derivative` and how it differs from `dx`, which has been used in the previous sections.
 - Caption extended with explanation of the difference with the conventional `.dx`
 5. Section 5.4.3: Instead of using point sources for the Poisson problem and visualizing them, I suggest using the Method of Manufactured Solutions to shown that the Devito implementation is correct.
 - We do agree that MMS would improve the verification of the implementation. However, the integration and implementation of MMS in and for Devito is currently in progress and not available in the version presented in this Paper. However, as we explained in the paper, all part of Devito are tested including the finite differences against polynomial (for which FD is exact for a properly chosen order) and are available in the `test` subfolder of Devito.

Editor

Dear authors

Moreover, I have some comments.

Regarding the content:

1. I have a question on Fig. 21. If I had connected all symbols with the same `dx` (not the same order as done here) in order to show the dependence of runtime on order, I would have expect to see monotonically decreasing curves. Is the numerical time step fixed? For `dx=2m` for instance, runtime increases slightly up to order 8, but the the order 10 simulation is faster. So the general finding on p24116 is not really correct. Could you elaborate on this and modify the manuscript accordingly.
 - In this figure, the time step is defined by the CFL condition and therefore it is bigger for `dx=4m` than for `dx=2m` (roughly `dt` is doubled), but the time step is fixed for a constant grid spacing. However, the runtimes take a lot of different parameters into account, which are not all listed in the manuscript. A complete overview of the Devito compiler paper has been submitted independently and is referenced in the performance section. Overall, the compiler performs optimizations such as factorizations, flop reductions, etc., that will lead to non-monotonic runtime variations. Secondly, the solver contains source and receiver interpolations that impact the performance in a non-linear way. Finally, as the roofline model shows, higher order stencils allow better usage of the hardware (better ratio of FLOPs/sec) and will perform better in some cases than lower orders, due to better flop vs memory traffic.
 - Clarifications have been added to the paragraph.
2. If you want you can include the alternative verification approach proposed by the reviewer concerning the Poisson equation. I agree with the reviewer, that Fig.20 is no formal verification, however I think that main intent of the new application examples is to show the versatility of Devito. In any case, future Devito users have to take care, that for their specific problem, Devito produces reliable solutions.

- Indeed, as you pointed out, this example mainly shows the versatility of Devito adding CFD examples as requested by the previous reviewer. While a more proper verification, such as MMS, would improve this example, we do not have it implemented at the moment and for the version of Devito presented here. This is however a work in progress and will be properly explained in a follow up paper that will also include staggered grid and domain decomposition, two points that were raised by one of the reviewer.

Regarding language etc:

1. p1318: “on its library Revolve”, what does “its” refer to?
 - Rephrased for clarity
2. You sometimes miss the parentheses around the citations, e.g. p2122, p3133 or opposite way p20120
 - Citation fixed.
3. I spotted several typos: p2129, p313, p8115, p12110: Fig., p15121, p17111, p18112: remove “we”?, p2014 (10): missing O?, p2018: “the PDE solve part”?, p2215 “corresponds to” = “consistent with”?, p27113 This list is quite long and probably not complete, hence I expect that you go over the whole manuscript to find further typos.
 - Removed lots of typos.
4. What about the Witte-manuscript “.. Part 3 Optimization”. Has it been accepted in the meantime? The provided URL does not look like a link that will live.
 - This paper is accepted and the bibtex entry is updated to the journal url doi.

Best wishes, Simon Unterstraßer