Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2020-336-RC1, 2021

Geoscientific Model Development Discussions
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EGU

Interactive comment on "LoopStructural 1.0: Time aware geological modelling" *by* Lachlan Grose et al.

Italo Goncalves (Referee)

italogoncalves@unipampa.edu.br

Received and published: 5 January 2021

I would like to congratulate the authors for their effort in developing open-source software for use in the geosciences. I believe we are close to the critical point where open-source tools will see a rise in adoption by the industry, ushering a new cycle of engagement and development that will benefit the whole field.

Overall, the article is clear and well-presented. I consider it in a suitable form for publication, after the minor points below are addressed.

Line 23: It may be interesting to mention the difference between manually drawn explicit surfaces and mathematical explicit surfaces (https://en.wikipedia.org/wiki/Parametric_equation). Some people favor the latter

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definition while I personally prefer the former. I don't think there is an "official" definition of geological explicit vs implicit surfaces yet, so this is an opportunity to take a step in that direction.

Line 28: Distance from the surface is not the only way to encode the observations. Gonçalves et al. (2017) work with fixed positive/negative values, while Hillier et al. (2014) use inequality constraints. These would fit in your potential field definition in section 2.1.

Line 119: "black and gray arrows. . .". Do you mean solid and dashed arrows?

Figure 1: What do you mean by "norm of the implicit function"? If we are dealing with a scalar field, its gradient at a given point has a norm, but I am unfamiliar with the concept of a norm for the field itself. Also, it might be worth mentioning that the gradient constraint is composed of one linear constraint per dimension.

Line 209: Are these alternative regularizers implemented in the package? Do they provide very different results from the standard one? It would be interesting to discuss situations in which one may be preferable over the other, or to point to works that do so.

Line 216 seems to be misplaced.

Line 221: Is the interpolation problem always over-constrained in practice? If I understood correctly, M is the number of nodes and N is proportional to the number of data points. Is that so? Are the regularization constraints added to N? If $N > M$, shouldn't the shape of the matrix $\mathbf{A}$ be $N \times M$? Also, it seems that the number of basis functions is defined by M in this case (one per node).

Lines 341-350: A figure illustrating these difficulties would be useful.

Lines 363-383: If the different α values are scalar angles, are they really necessary in the equations, since they represent zero value constraints? It would be useful to write the vectors in boldface, in order to better distinguish them from the scalars. What is

h_s?

Line 387: “fold axis of the experimental variogram”. Do you mean the experimental variogram of the fold axis rotation angle?

Line 481: Instead of pure noise, perhaps you could sample from a spatially correlated model (this can be easily done through the Cholesky decomposition of the covariance matrix), maybe with 10-20% noise, or even the sum of 2-3 structures with different ranges. It may help to better convey the points made later in the text about prioritization of local/global trends. Exact interpolation of noise will certainly result in unrealistic surfaces. I feel the examples are being somewhat unfair to the RBF model.

Line 484: The acronyms PLI and FDI should be defined right alongside their first mention in the text.

Section 4.2: Being a non-geologist, it is hard for me to visualize the effect the data has on the final model based on the provided figures. Perhaps you could expand Figure 12, showing the measured orientation disks along with some isosurfaces in 3D.

Figure 13: The text is too small.

Line 634: do you mean $\mathbf{Ax} = \mathbf{b}$?

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