Qeios

Peer Review

Review of: "Data-Driven, Parameterized Reduced-order Models for Predicting Distortion in Metal 3D Printing"

Leon Herrmann[1]

1. Technische Universität München, Germany

The authors apply POD with Gaussian Process Regression to speed up displacement computations in laser powder bed fusion computations (with the intention of faster calibrations & pre-distorted shape estimation). The text is well-written. However, several unclarities remain:

- Introduction: What is the motivation for comparing the POD/Gaussian Process Regression with a graph-convolutional autoencoder? You provide a motivation in the conclusion, but this is too late. Please motivate the comparison.
- Methods: What kind of geometries are you considering? Is it always the same geometry and not truly an “interpolation” between different geometries, but only an interpolation between the process parameter “dwell time”?
- Methods: How large is N_\mu? According to the nine dwell time simulations, I would guess 9? Thus, building the model for a single geometry would require nine full simulations. Is this more or less than what is usually required to calibrate the dwell time? Consider providing a breakeven threshold, which defines the number of times the model needs to be used to make the training worth it (and put it into the context of your application, i.e., if the threshold is realistic).
- Results: Why do you only compare maximum displacements? Appropriate measures, like energy norms, visual displacement field comparisons, or even gradient comparisons in terms of strains, would be more insightful.
- Results: You mention that the graph-convolutional autoencoder would improve with a larger dataset. How do you support this hypothesis? Furthermore, consider the breakeven threshold as you should in your POD/Gaussian Process Regression.

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- Conclusion: You mention weak-LaSDI, which should briefly be motivated (and at least the abbreviation should be explained).

Declarations

Potential competing interests: No potential competing interests to declare.