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Peer Review

Review of: "Parameter Calibration for Johnson Cook and Preston-Tonks-Wallace Material Strength Models with Uncertainty Quantification"

Jesus Enrique Pereira Pires[1]

1. University of Michigan - Dearborn, United States

General Overview:

The presented work utilizes Bayesian calibration to learn and quantify the uncertainty in the model parameters used in two material strength models: Johnson Cook (JC) and Preston-Tonks-Wallace (PTW). Additionally, the capacity of these models to fit experimental data from quasi-static and Hopkinson bar experiments on Oxygen Free High Conductivity (OFHC) copper was presented. Overall, this work provides some experimental insights into the suitability of the JC and PTW models to fit data from the stated experimental conditions. Nevertheless, some observations that could be considered to improve the overall quality of the work are presented below:

- The prior distribution used for parameter **A** in the JC model had a mean of 90 MPa and a variance of 10% of this mean value (i.e., a COV of 10%). Additionally, a multivariate Gaussian distribution was used as the prior PDF, with no correlation. With that considered, the result of the Bayesian calibration yielding **A = 0.05 MPa** does not correspond to a physically sound result, as pointed out by the authors. If previous publications have shown that the value of **A** for OFHC copper should be around **69-365 MPa** as stated, the difference could be attributed to the model not being suitable to explain the material behavior under the experimental conditions considered, or it could be a consequence of errors in the experimental procedures. In any case, I would suggest the authors discuss these possibilities to showcase “why” the JC model does not seem to yield a reasonable **A** parameter.
- The updated model parameters for the JC model were provided in the manuscript but not for the PTW model. It would be insightful to showcase the resulting model parameters for this second model after

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Bayesian calibration and include a brief discussion about them to verify if they retained their physical interpretation.

- An illustration in the **Models** section showcasing the model parameters, inputs, and outputs for both the JC and PTW material models should be included for clarity.
- The authors provide a brief introduction to the JC model parameters but not for the PTW case. I would suggest including some description of these parameters from their physical interpretation so readers can have a grasp of their meaning.
- **Figure 4 and 9** show four sets of experimental results with their corresponding predictions based on the JC and PTW models. Nonetheless, it is difficult to assess the quality of the fit based on the provided figure as almost all curves are overlapped with each other. I would suggest generating a figure based on a 4x2 grid with each row corresponding to an experiment and each column to a model. This would help the readability of the figure.
- All figures showing "stress vs true strain" results (**Figures 3, 4, 5, 8, 9, 10**) should have the same y-axis limits for both plots (JC and PTW) to facilitate the direct comparison of the predictions using both models.
- I would recommend briefly describing the process behind the variational Bayesian method so unaware readers can get a grasp of this technique. Additionally, I would include an adequate citation so interested readers can dive deeper into the topic if interested.
- The authors provide results for the updated variances, but there is no description regarding the exact quantity they are using to assess "uncertainty" (is it the covariance of the posterior distribution?). A section should be included describing how uncertainty is quantified for the model parameters based on the variational Bayesian technique.

Declarations

Potential competing interests: No potential competing interests to declare.