**Rebuttal**

I deeply appreciate the time and effort put forth in reviewing this paper. I value all of the noted corrections and suggestions as to how the paper can be better. As per the feedback, all editorial changes were implemented. This included all suggested font changes, requests for rephrasing of confusing statements, APA formatting errors, and the like. The only exception was that the citations at the end of the work were completed as per APA 6 rather than APA 7. This was done because much difficulty was encountered in tracking down the conference editor’s names required for APA 7. The comments along with the authors response to them are shown below.

Review A Comments for Improvement: A-120580 e-mail

* “*revise your abstract to mention the manufacturing aspect of your work*”
* “*several areas where phrasing needs to be clarified*”
* “*figure captions need to be edited to fit APA guidelines*”
* “*update highlighted references to fit APA guidelines*”

Reviewer B Comment for Improvement: A-120580

* Abstract: “*Mention manufacturing aspect here as well*”
* Introduction: “*Add hypothesis*”
* Related Work: “*This makes it sound like you will review more than two methods. Since you only cover two methods, say that, and then explain why you chose those methods in particular*.” “*Highlighting technique names like this isn’t necessary. It’s fine to just say multiple interference detection* with no italics or quotes”. “*Again, this makes it sound like you’ll discuss more than one technique*”
* Generation of the Robot’s Swept Surface: “*Spacing between paragraphs is inconsistent in this section*”. “*This is not APA format for figures (applies to all figures in your paper)*”. “*Consider labeling these a) and b) instead of using left and right*”
* Generation of the Obstacle Trajectory: “*This sentence seems out of place here. Maybe move it to the start of the next section?*”
* Run time data for the Collision Detection Algorithm: “*Your results indicate that past the point where the collision is first correctly identified, increasing the resolution just makes the program slower*”
* References: “*I think APA 7 has changed the format slightly so you need to include editors of conference proceedings:* [*https://libraryguides.vu.edu.au/apa-referencing/7ConferenceMaterials*](https://libraryguides.vu.edu.au/apa-referencing/7ConferenceMaterials)”

Editor’s Comments, Michelle Leonard: A-120580

* References: “*URL?*”, “*Full title*”, “*Needs full journal title*”

Review A Comments for Improvement: A-121680 e-mail

Good points:

* “*clear abstract & goals*”
* “*meaningful contribution to the field*”

Improvements to be made:

* “*include definitions for terminology your audience may not know*”
* “*multiple places with awkward/unnatural phrasing*”
* “*Figures need to be updated to meet APA guidelines & moved closer to where they're first referenced in the text*”

Reviewer B Comment for Improvement: A-121680

* Abstract: “*Good, clear abstract*”
* Introduction: “Coons patches - *Will your audience know what this term means?*”
* Related Work: “*format this as multiple interference detection and Swept volume interference w/o italics & quotes*”. “swept volumes - *define this term?*” “By implementing Coons patches to interpolate the human’s position throughout time - *is this the previous work mentioned in the introduction?*”
* Methods: “assumes as its only input the predicted motion derived from simulated sensor data describing joint angles of a human’s articulated multi-link body at various instants in time. - *This is confusingly phrased*”
* Figure 1: “*Move this to where you discuss Figure 1 in the text*”. “*Additionally, figure captures in APA should have the ‘Figure 1’ italicized, not bolded*”
* Application of Coons Patches to Connect the Boundary Curves: “each straight segment of the human as the segment travels between two different orientations. - *I don’t understand what this means*”. “*Good phrasing of key takeaway*”. “Completing the above calculation for the patch, a ) set of points within the boundary curves is created - *Awkward phrasing*”

Response:

As per both reviewer’s comments, the work was revised with the following changes. Unclear or highly technical vocabulary was elaborated on and explained in more detail. For instance, phrases like Coons patches and Swept Volume Interference were explained in further detail. Locations in which reviewers noted awkward or confusing verbiage were rewritten with a goal of improving clarity. As per the suggestion of the reviewers, figures were moved to be located closer to the first reference to the figure in the text. Additionally, various comments about deviations from the APA guidelines were noted. All deviations from the guidelines were fixed apart from the citations. In the citations, the APA 6 guidelines as opposed to the APA 7 guidelines were used. Permission for this was given by Prof. Leonard. All suggested editorial changes, such as using fonts versus italics and dropping quotation marks were implemented. For instance, the terms *“Multiple Interference Detection”* and *“Swept Volume Interference”* were un-italicized, and the quotations were dropped.

Reviewer A Comment for Improvement: A-120580 *“your results are unclear as to how much of an improvement your technique is over the current standard methods. It would be helpful to have a side-by-side comparison”*

Reviewer B Comment for Improvement: A-120580 *“It would be good to see time & collision results for the two methods you highlighted in your related works. Without them, it’s hard to evaluate the performance of your algorithm w/r/t what’s already being done in the field”*, Section: Evaluation, Table I.

Response:

Reviewer comments on an earlier version of this work asked for more benchmarking and a side by side comparison of this algorithm with other similar algorithms. This paper improvement, while attempted multiple times throughout the initial submission and revision, proved to not be feasible for the following reasons. During the literature review, few papers were found that outline algorithms similar to this one. While there are a number of papers about swept volumes, this topic is an older computer graphics topic that has not had extensive implementation in predictive collision detection of robots. Thus, direct comparison was difficult.

Furthermore, the papers that do bear more similarities to this work proved to not be repeatable. There was no open source code, and not enough details were given in the publications to reproduce the work. To have attempted degraded approximations of these works (degraded due to the authors lack of expertise on other’s research and the lack of particular detail in the work) for benchmarking would have been misleading and not useful. Even if the algorithms developed in these works were available, the situations surrounding the implementation were often not similar to this work.

For these reasons, rather than relying on the relative computational ability of this algorithm, other successes of the algorithm should be highlighted to differentiate it. This algorithm was shown to run in real time, and this was our primary speed requirement. On top of achieving this, the algorithm serves as a unique approach to modeling an entire trajectory of the robot rather than just a projection of the robot into an immediately future state. The algorithm provides point clouds that can subsequently be used in a replan if desired. It is particularly suited to online operation in Human Robot Collaboration settings. Stated concisely, this work addresses the challenge of predicting collisions for the scenario of human-robot interaction within a manufacturing environment in which the appropriate robot behavioral reaction-response must occur within real time to ensure safety while respecting productivity. A Coons patch modified swept volume approach is presented. According to a literature review this method is found to be both unique, and competitive, displaying distinct advantages.

Side by side, continuous data high resolution…..hybrid of the two methods to …..is there literature comparing the other two….how to demonstrate our method falls in-between in terms of computational efficiency and resolution. Any numbers available?

Again, gratitude cannot be overstated for the time taken by the reviewers to evaluate this work and provide feedback. The feedback has been deeply appreciated and, to the author’s best abilities, implemented.