**Reviewer #1**

*We have no points to make further clear based on Reviewer #1 comments. Thanks for his/her feedback.*

**Reviewer #3**

* + Although the contribution does not extend the algorithm of the approach that it builds on [15], it does provide significant improvements on complexity with a well-developed complexity analysis and experimental evaluation.  
      
    Although the authors make a notorious effort in providing illustrations to help understand the proposed approach, I think that it would help to add in Fig. 1 details on the mapping between the task space and the surface for which this example is built.

*(The reviewer wants to know details of the physical meaning of Fig.1. I think we can improve it at Fig.1 caption, or add another figures as you suggested in the email)*

*Thanks for the advice. We should have started the introduction from a concrete, physical coverage task carried out by non-redundant manipulator instead of an abstract graph. We plan to add subfigures showing the manipulator configurations and such as the following sentences for explanation in Fig.1 legend or in main chapters:*

*In realistic scenarios, the set of blue points and green points may represent non-redundant “elbow-up” poses and “elbow-down” poses, with their end-effector (EE) keeping in touch with the object surface. Any path connecting a blue point and a green point there must contain an ``elbow-straight” configuration which is singular, thus discarded in EE contact tasks. So the “colours” are disjointed in the joint-space. Since the manipulator forward kinematic is injective, the corresponding end-effector poses on the surface can also be represented in colours.*

*However, one point on the surface may correspond to multiple usable colours, for the IK mapping is not injective. And the NCPP task is essentially choosing appropriate IK solutions (colours) such that minimal number of connected colours are used.*

* + Also, I recommend to be more concise throughout the paper.

**Reviewer #4**

* + The results in this paper are I believe of interest to the community. I have to admit however that, for the non-expert on this sub-area of motion planning, I believe this paper is currently not easily readable and should be significantly revised with a focus on readability for non-experts and with attention to precision and clarity of claims and definitions.

*Thanks for the advice. We will add more sentences focusing on introducing the background, the interpretation from a physical manipulator NCPP task to the solution of the abstract topological graph, including but not limited to the above-mentioned improvements on Fig.1 as suggested by Reviewer #3. And we will give a formal definition of the NCPP task before going into detailed analysis of solving topological graphs.*

It would help tremendously if the authors would make formal definitions in definition environments, for example to rigorously define "an intersection", as discussed in II A and to also formally put the underlying graph definition in a definition environment. The same holds for the section on defining Strips and to make a formal problem definition in the introduction. Similarly, for claims such as "proofs of complexity", a formal theorem + proof environment would clarify the exposition. Finally, the key algorithm proposed in this work could be condensed into a formal algorithm environment for clarity and precision. Browsing through the references, it seems that the cited paper [12] may provide much of the required background details, but given limited time and viewing the paper as self-contained, I am unfortunately not able to verify the correctness of the work as a result of uncertainties about the underlying constructions and definitions.

*(It seems that the reviewer cannot find a clear definition and just wants them to be listed outside paragraphs? I’m not sure whether we should give all definitions in the rebuttal. I write them here and we judge later. )*

*Thanks for the advice. We will move our definitions and important claims into special environments to make them easily findable. Yes, the cited paper [12] is the basis of our submission, and many related terminologies such as “cell” and “cellular decomposition” are borrowed from it. We will only insert necessary parts from the cited paper to make the paper both self-contained and obey the length limit.*   
  
For example: Could the authors provide more background on the used cell-decompositions? How do they arise, what kind of cell decompositions are these? CW-complexes? Should cells be contractible? What properties are required of the cells?

*(I think we only need to show to the Area Chair that we have these, and it will be OK? )*

*Thanks for the advice. We will introduce the related terminology in our revised paper. Examples of them are as follows:*

*(1)The definition of “cells” comes from the classic coverage path planning (CPP), a part of the region to be covered. For the manipulator coverage task, the cell is a part of the surface of the object to be manipulated. In our paper, the cell is constructed based on the valid inverse kinematic solutions and their joint-space continuity. Given the non-redundant manipulator kinematic, the object and their related poses, the valid IK solutions used for the NCPP task are well-defined. The cell is defined as a maximally connected set of points which have same kinds of IK solutions. For example, in Fig. 1 there are 11 cells. For more details please refer to the cited paper [12].*

*(2)The terminology “cellular decomposition” is neither the one used in algebraic topology. It is used in solving CPP problem, representing the division process of the region to be covered. In the manipulator NCPP task, it is referred to as a partitioning of the object surface.*

A short formal definition of how cells yield presumably space filling paths on each cell would clarify how this is related to path planning, and how this is achieved in the actual experiments.

*Once the region is separated into cells with simple shapes, it is a commonly agreed approach that a template coverage path (such as a Boustrophedon path or a spiral path) can be easily constructed to be the coverage path, which is the path of the end-effector in the manipulator NCPP task.*

*A difference between the manipulator NCPP task and the classic CPP problem is that, due to task-specific constraints, the manipulator moving in the joint-space may not be able to make its end-effector follow the pre-designed coverage path, where end-effector lift-offs are incured. And this work (also, the cited paper [12]) aim to find the optimal cellular decompositions such that minimum number of end-effector lift-offs can be obtained. And we omitted detailed visualization of the geometric coverage paths because the proposed algorithm functions exactly the same as the cited paper [12].*

In the experimental section, it was also not clear to me how the cells and required numerical discretizations were obtained and no time/memory complexity analysis is provided to allow the reader to understand how close the proposed methods are to real-world use readiness. Adding these details would significantly improve the readability of the paper to the general RSS audience.

*Thanks for the advice. We will add more details about the experiment implementation in our revised version.*

Other comments:  
- the current draft should be shortened to 8 pages to conform to the submission guidelines. At the moment there is an overflow due to a citation.

*We argue that the current draft for our submission is fit for the required length limits. We have put all our sections within 7.5 pages, with only citations going over 8 pages. And thus there should be still half a page for us to address other issues raised by reviewers.*