Review of JCOMP-D-13-00928: Discontinuous Finite Element Solution of the Radiation Diffusion Equation on Arbitrary Polygonal Meshes and Locally Adapted Quadrilateral Grids

This paper describes a new approach to the solution of the radiation diffusion equation on arbitrary polygonal meshes and meshes consistent with adaptive mesh refinement (AMR), using a discontinuous finite element approach with the symmetric interior penalty technique. My recommendation is that this paper be published after some minor revisions. The author does a great job making clear the distinct contribution of the paper and distinguishes this research from that performed previously.

The most significant revisions necessary include

1. There is no mention anywhere in the paper that one downside of discontinuous finite element methods, when compared with continuous finite element methods, is the much greater number of unknowns. This should be pointed out, and if there is a computational expense associated with this increased number unknowns, it should be discussed.

2. There is no investigation of the effect of the user supplied parameters in the symmetric interior penalty (SIP) technique, nor is there any discussion of whether the results that are obtained are sensitively dependent on these choices. Do the results obtained require the choices of C and $h_\perp$ made by the author? Will other choices lead to poorer or better performance?

A list of typographical, grammatical and notational errors follows. Note: page numbers are those in the document provided to the reviewer, not those provided by the author.

1. Page 4: "such as the ones shown on..." should be "such as the ones shown in..."

2. Page 4: "surrounding the specified vertex v.." should be "surrounding the specified vertex p..."

3. Page 4: "methods create discrete analog..." should be "methods create discrete analogs"

4. Page 4: "of arbitrary polygons/polyhedrons..." should be "of arbitrary polygons/polyhedra..."

5. Page 6: "The polygon needs not to be convex'." should be "The polygon need not be convex."

6. Page 7: "vertex and to zero at all.." should be "vertex and equal to zero at all..."

7. Page 7: "representation within a polygon" should be "representation within a polygon."

8. Page 7: "and a degenerated pentagon, the later..." should be "and a degenerate pentagon, the latter..."

9. Page 7: "We refer the Readers..." should be "We refer the reader..."

10. Page 7: "Dirichlet boundary conditions to the model..." should be "Dirichlet boundary conditions for the model..."

11. Page 9, Equation (3): The notation in this equation isn't well described. In particular, the "normal derivative" is not defined, and this shorthand is incomplete.

12. Page 9, line 169. The last sentence in this paragraph should be moved up in the paper such that it is introduced right after this notations first use.

13. Page 10: "one of the edge sets..." should be "one over the edge sets..."

14. Page 10: "is always to outward point unit normal..." should be "is always the outward pointing unit normal..."

15. Page 10: "from the cell pointed by $\vec{n}$..." should be 'from the cell pointed to by $\vec{n}$..."

16. Page 11: "where C is a constant, ..." should be "where C is a constant and ..."

17. Page 11: "is, therefore to monitor..." should be "is therefore used to monitor..."

18. Page 13, sinusoidal grid transformation: the subscript on the $\hat{y}$ should be j not i, I think...

19. Page 13, "The discrete linear system of equation..." should be "The discrete linear system of equations..."

20. Page 13, "This test consists in..." should be "This test consists of..."

21. Page 14, "Fig. 6 presents the isolines obtained for this problems..." should be "Fig. 6 presents the isolines obtained for this problem..."

22. Page 14, "the vertices of a rectangular grids..." should be "the vertices of a rectangular grid..."

23. Page 14, "on their quadrilateral equivalents, that is, ..." should be "on their quadrilateral equivalents; that is, ..."

24. Page 14, "still contain some feature..." should be "still contain some features ..."

25. Page 14, "Table 2 summarizes the types and number.." should be "Table 2 summarizes the type and number ..."

26. Page 17, line 317. It would be nice for the reader to know that that author has computed the correct $Q(x, y)$. The paper should show the formula for this quantity.

27. Page 18, "function of the number of unknowns rate is graphed..." should be "function of the number of unknowns is graphed..."

28. Page 18, "and exhibit reduced rates for highly distorted..." should be "and exhibit a reduced convergence rate for highly distorted..."

29. Page 18, "a value of 0.5 correspond to ..." should be "a value of 0.5 corresponds to..."

30. Page 18, "drastically looses such a rate for more..." should be "drastically loses this property for more..."

31. Page 20, "However, recall that this denomination only..." should be "However, recall that this nomenclature only..."

32. Page 22, "In this series of run, ..." should be "In this series of test problems, ..."

33. Page 24, "AMR grids with the ones of uniformly refined grids..." should be "AMR grids with that observed when using uniformly refined grids..."

34. Page 25, "second-order accuracy of PWLD ..." should be "second-order accuracy of the PWLD ..."

35. Page 25, "The location of peak in ..." should be "The location of the peak in ..."

36. Page 25, "Fig. 18(d) presents a zoom on the AMR grid ..." should be "Fig. 18(d) presents a magnification of the AMR grid ..."

37. Page 25, "where one can note the presences of several ..." should be "where one can note the presence of several ..."