



SDI FINAL EVALUATION FORM 1.1

PART 1:

Journal Name:	British Journal of Mathematics & Computer Science
Manuscript Number:	MS: 2013_BJMCS_3400
Title of the Manuscript:	Are Near Earth Objects the Key to Optimization Theory?

PART 2:

FINAL EVALUATOR'S comments on revised paper (if any)	Authors' response to final evaluator's comments
My view of what a scientific article should look like, seems different from the one of the author. In my opinion, the article should investigate why different curves look similar, and not simply pose the question; a scientific article should avoid expressions as "it is difficult to imagine that their similarity is accidental" or "...coincidence, which seems highly unlikely", whereas it should prove that they are not. A reviewer has instead the right to express his impressions and opinions, even not demonstrated; if I had "to explain exactly why CFO's Davg curve behaves the way it does" I would write an article, not a review. I stand with my opinion of the similarity being accidental; first, plateaus in deltaV curves are not flat (the logarithmic scale used in Milani's figure may be deceptive) but there is a (well documented) constant increasing trend in DeltaV as deflection is postponed, and this fact has no similarity with trapping; second, many chaotic system exhibit similar trends, with oscillations and plateaus: graphs describing temperature trends (steps corresponds, e.g., to volcanic eruptions) EEG, stock exchange indexes; a rapid search on google images provides plenty of examples; finally, DeltaV oscillations are perfectly explained by the influence of the asteroid eccentricity and steps by close flybys that modify the geometry of the following encounter, and the article does not (but should) highlight if this concepts occur in CFO. My suggestion about CFO improvements did not want to diminish the algorithm merits, but stimulate the author to investigate, for instance, periodicities in the particle behavior, effect of inertia (the CFO examples I found put the inertial term to zero). In my opinion a useful scientific article should investigate such very interesting questions. It is true that sometimes posing a question may be more important than finding the answer but this does not seem the case.	The author respectfully disagrees with the reviewer's comments and rebuts them as follows. It is the reviewer's <i>personal</i> "view" is that the article is fatally flawed because it poses a question without answering the question it poses. He suggests that the author's view is different from his, which indeed is the case. And it appears that it is the author's view, not this reviewer's, that is shared by the two other reviewers, neither of whom brought up the reviewer's objection to this article. While reasonable people may differ on whether or not in order to be publishable a paper that raises a question must answer the question it raises, the author suspects that far more people will reject such an artificial and capricious standard than will embrace it. The importance of raising unanswered questions is the subject of an article by Tom Siegfried who writes: ... But great questions often make very good science. <i>Unsolved mysteries provide science with motivation and direction. Gaps in the road to scientific knowledge are not potholes to be avoided, but opportunities to be exploited.</i> “Fundamental questions are guideposts; they stimulate people,” says 2004 Nobel physics laureate David Gross. “One of the most creative qualities a research scientist can have is the ability to ask the right questions.” Science’s greatest advances occur on the frontiers, at the interface between ignorance and knowledge, where the most profound questions are posed. <i>There’s no better way to assess the current condition of science than listing the questions that science cannot answer.</i> “Science,” Gross declares, “is shaped by ignorance.” (emphasis added). The above passage is excerpted from American Association for the Advancement of Science article "In Praise of Hard Questions," <i>Science</i> Magazine, 1 July 2005, vol. 309, no. 5731, pp. 76-77, DOI: 10.1126/Science.309.5731.76, www.sciencemag.org (copy attached). The reviewer's "view of what a scientific article should look like" appears to be completely at odds with Tom Siegfried's view of how important unanswered questions are, and, indeed, Professor Gross's as well. Of course, the reviewer is entitled to his personal opinion, but imposing it as a standard for publication obviously is well beyond the pale. As to the reviewer's specific comments on CFO, the author reiterates that the point of the article is simply and solely to raise the question of why CFO's Davg and a trapped NEO's deltaV curves look alike. The reviewer quibbles about specious points such as the plateaus not being "flat," or the plots' scales possibly being "deceptive," but none of this diminishes the curves' obvious visual similarity in their oscillatory behavior that constitutes the CFO-NEO nexus. No one looking at the curves can plausibly assert that their appearances are not similar. The question is, Why? Of course, the reviewer might be right - maybe the similarity is, in fact, purely coincidental. But, on the other hand, the reviewer might be wrong - maybe CFO's probes' trajectories and the motion of a trapped NEO are somehow fundamentally related. The author has stated plainly that he does not know which of these



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	is correct. The very point of the paper is to present the question to experts in gravitational kinematics and optimization theory for the purpose of encouraging the collaboration that might provide the answer. The reviewer is of a mind that this is an unreasonable thing to do and, as a result, the paper should not be published. That view strikes the author as both unreasonable and extreme because it deprives the scientific community of even the option of looking into a possible CFO-NEO connection. The reviewer's comments indict CFO's implementation because, as an example, the algorithm "put(s) the inertial term to zero." The reviewer apparently does not understand that CFO is a <i>metaheuristic</i>, not a model of gravitational kinematics. The analogy to gravitational kinematics is a <i>metaphor</i> drawn from Nature that is no different than the biological <i>metaphors</i> underlying the <i>metaheuristics</i> Ant Colony (ACO) or Particle Swarm Optimization or Genetic Algorithm, or the physics analogy underlying Synthetic Annealing Optimization. Attached is a copy of Dorigo <i>et al.</i>'s article on ACO that explains these ideas. The following excerpt is relevant: "A <i>metaheuristic</i> is a set of algorithmic concepts that can be used to define <i>heuristic</i> methods applicable to a wide set of different problems. In other words, a <i>metaheuristic</i> is a general-purpose algorithmic framework that can be applied to different optimization problems with relatively few modifications. Examples of metaheuristics include simulated annealing [24], [25], tabu search [26]–[28], iterated local search [29], evolutionary computation [30]–[33], and ant colony optimization [8], [22], [23], [34]." (<i>emphasis added</i>). CFO's metaphorical nature is further described in reference [4] in the reviewed paper (copy attached), to wit, "Imagine an object whose mass is small compared to the earth's moving through space on a trajectory that brings it close to our planet. Under certain conditions the object can become gravitationally trapped, so that its orbit is modified by the encounter, at least for a while. In the absence of energy dissipation, orbital changes can occur for some period of time while the object and the earth exchange energy in a conservative manner. <i>The small object may become 'trapped' in proximity to the earth, and it is this effect that the CFO metaphor embraces. Of course, CFO is an algorithm, a step-by-step procedure for processing numbers. It is not literally, nor is it intended to be, a precise model of how a small mass moves through space on a path that brings it close to a planet.</i> Indeed, the problem of calculating the motion of even three gravitating bodies remains unsolved to this day, after nearly 250 years [Marion, (1970), §8.12]! CFO is a 'conceptual' approach to multidimensional search and optimisation. It draws its inspiration from gravitational kinematics and, in a formal way reflects the equations underlying gravitational motion. But the similarity ends there, ..." (<i>emphasis added</i>). In order to emphasize and clarify what CFO is, and to avoid any confusion along the lines of the reviewer's comments, the above excerpt has been paraphrased and added to the reviewed paper as a new revision. The author believes that these remarks fully address the reviewer's comments.
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