



SDI Review Form 1.6

PART 1:

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

General guideline for Peer Review process is available in this link:

(<http://www.sciencedomain.org/page.php?id=sdi-general-editorial-policy#Peer-Review-Guideline>)

- This form has total 9 parts. Kindly note that you should use all the parts of this review form.



SDI Review Form 1.6

PART 2: Review Comments

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
Compulsory REVISION comments	I do not agree with the author's statement that "it is difficult to imagine that their ' [i.e., of figure 3.a and 3.b] ' similarity is accidental"; the only relation is the chaotic behaviour of multi-body gravitational dynamics and of CFO particles, but I do not think that this relation has an actual relevance. The jump in figure 3b is related to a close passages of Apophis in the vicinity of the Earth (flyby) in 2029, which reduces the distance at the 2036 encounter; changing Apophis orbit before 2029 is much more convenient as the 2029 flyby amplifies the effect on the miss distance; the final rise (close to 2036) in figure 3b is instead related to the fact that the deviation effect on the miss distance grows with time (this explains also the non-horizontal plateaus of fig 3.b) and the later the asteroid orbit is changed, the larger is the deflection to achieve the required miss distance. Oscillation have instead a deterministic behaviour related to the asteroid period, as deflection is more efficient when applied close to the perihelion. The asteroid "trapping" in earth orbit is fortuitous (and fortunately extremely rare) as the effect of any flyby could be that of changing the asteroid orbit so as future impacts are avoided. With today's data, Apophis will actually miss the earth in 2036 (no trapping) and the following close encounters will be with large miss distances. Fact is that close approaches occur between bodies with intercepting orbits and the synodic period	The author respectfully rejects this comment as being specious. CFO is a well-established global search and optimization algorithm (the subject of more than two dozen peer-reviewed papers since its introduction in 2007). It happens that the D_{avg} curve for CFO's probes often exhibits a oscillation in plateaus under local trapping. This is an empirical observation, an undisputed fact, and it is fully described as such. It also happens that an NEO's ΔV curve exhibits oscillation in plateaus during non-energy dissipating gravitational trapping as demonstrated by Apophis' curve. This observation is based on the analysis by others of Resonant Returns, also an undisputed fact, and it is fully described as such. There is no question that the curves D_{avg} and ΔV curves look very much alike, and the question is, Why? The paper raises this single question and nothing more. If it happens that the similarity is <i>not</i> accidental, (the reviewer asserts that it is accidental), then CFO's gravitational basis and real gravity are much more closely related than a simple analogy, in which case the entire panoply of mathematical analysis developed for NEO gravitational kinematics may be applicable, directly or by extension, to the further



SDI Review Form 1.6

	determines their frequency; I do not see the concepts of orbit and period in CFO; on the other hand gravitational trapping of CFO particles seems not related to periodical close approaches.	development of CFO as a global search and optimization algorithm. This is the point of the paper. But the reviewer seems to have missed this point entirely, and instead offers his <i>opinion</i> that there is no merit in asking the question that the paper presents. Of course, without a detailed analysis, there is no way that the reviewer knows <i>as a matter of fact</i> that "gravitational trapping of CFO particles seems not related to periodical close approaches," which is what he claims. His conclusion is not supported by any analysis whatsoever, and his statement that he does "... not see the concepts of orbit and period in CFO" is specious on its face. What he "sees" or does "not see" provides no scientific basis for answering the question that is posed by the paper. If the reviewer rejects out-of-hand the speculation that similarity between CFO's curves D_{avg} under trapping and a trapped NEO's ΔV curve is the result of a fundamental connection between the two, then it is incumbent upon the reviewer to explain exactly why CFO's D_{avg} curve behaves the way it does. But he fails to do so. If it is not a reflection of gravitational kinematics, then what is it? The reviewer's comment is verbose but completely non-specific, except as to his personal <i>opinion</i>. His comment thus lacks any foundation and consequently has no merit. Finally, it should be mentioned that prior to submitting the paper to BJMCS, it was vetted by
--	--	---



SDI Review Form 1.6

		several people, none of whom shares the reviewer's out-of-hand rejection of asking a simple, sensible question based on the obvious similarity in the D_{avg} and ΔV curves.
<u>Minor</u> REVISION comments		
<u>Optional/General</u> comments	CFO can be a useful tool for optimization problems. Perhaps, concepts taken from NEO dynamics could be used to improve the algorithm	Extensive additional discussion and references have been added to the paper because CFO already has been "proven" as an optimization technique, and it is not the intent of the reviewed paper to further address CFO's performance. The point of the paper is to raise the question of whether or not CFO's underlying gravitational metaphor and real gravitational kinematics are related because of the obvious similarity in the D_{avg} and ΔV curves. Central Force Optimization has been the subject of many peer reviewed papers, including two proofs of convergence, and application to various benchmark suites and to real-world problems with excellent results. The following text therefore has been added to the paper: "CFO analogizes gravitational kinematics, thus embracing the metaphor of Newton's precise laws of gravity and motion. CFO is similar in some ways to gradient-based optimization methods as discussed in [4]. Proofs of convergence for CFO and an extended version have been developed [5,6], and the algorithm has been implemented on a GPU using various topologies [7-9]. The algorithm has been successfully applied to a variety of problems, among them: training



SDI Review Form 1.6

		neural networks [10]; power grid reliability assessment [11]; drinking water distribution networks [12]; solving nonlinear circuits [13]; array synthesis [14,15]; microstrip patch antenna design [16]; multiband slotted bowtie design [17]; rectangular microstrip patch design [18]; microwave broadband absorber design [19]; antenna optimization generally [20]; notched ultra wideband E-shape antenna design [21]; and increasing impedance bandwidth [22,23]." Indeed, the abstract in reference [12] in the revised paper concludes: "...The results are then discussed compared to the previous works. It is concluded that CFO is easy to implement, computationally efficient and has a <i>remarkable performance</i> in solving leak detection problem." (emphasis added). A copy of that paper is attached. Thus, as an accommodation, the reviewer's comment has been addressed by adding extensive additional discussion and references, although it is not the intent of the paper to further address CFO's performance. The point of the paper is to raise the question of whether or not CFO's underlying gravitational metaphor and real gravitational kinematics are related as more than a simple analogy.
--	--	---