



SDI FINAL EVALUATION FORM 1.1

PART 1:

|                          |                                                   |
|--------------------------|---------------------------------------------------|
| Journal Name:            | British Journal of Mathematics & Computer Science |
| Manuscript Number:       | 2013_BJMCS_3381                                   |
| Title of the Manuscript: | Pseudorandomness in Central Force Optimization    |

PART 2:

| FINAL EVALUATOR'S comments on revised paper (if any)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Authors' response to final evaluator's comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The author did not address my main comments in a satisfactory way. The main problems remain:</p> <ol style="list-style-type: none"> <li>There is no computer command to assign an arbitrary value to a given variable. So one has to either (1) provide a deterministic algorithm that would work for all practically useful optimization problems (i.e., decision spaces) , which the author did not provide, or (2) use a probabilistic approach, which the author chose to stay away from. The author's speculation about a fundamental difference between "pseudo-randomness" and "true" randomness does not have scientific merit.</li> <li>The analogy with gravity is not adequately justified and, therefore, doesn't sound serious.</li> <li>The illustrative material is mostly of poor quality, not acceptable for publication. The problem is not with the quality of printing, but with the quality of illustrating results. The Figs 10 &amp; 11 are just a colourful mess, lines are crossing the legend. Instead of the big table, graphic illustration is needed, etc.</li> </ol> | <p><b>The author respectfully disagrees with every one of the reviewer's comments.</b></p> <p><b>1. The reviewer claims that the notion that pseudorandomness and true randomness has no "scientific merit."</b> This is an astonishingly ill-informed, indeed irresponsible, statement which happens to be <i>completely wrong!</i> As an example, I have reproduced below from a Harvard University Computer Science course website the description of a course whose <i>sole purpose</i> is to explore the <i>difference between pseudo and true randomness</i> (<i>emphasis added</i>). Perhaps the reviewer should visit that website and sign up for the course?</p> <p>(a) <a href="http://isites.harvard.edu/icb/icb.do?keyword=k76768">http://isites.harvard.edu/icb/icb.do?keyword=k76768</a><br/> Computer Science 225: <b>Pseudorandomness</b><br/> Harvard College/GSAS: 4869<br/> Spring 2010-2011<br/> Salil P. Vadhan<br/> Location: Maxwell Dworkin 323<br/> Meeting Time: M., W., 2:30-4</p> <p>Efficiently generating objects that "<b>look random</b>" despite being constructed using little or <b>no randomness</b>. Connections and applications to computational complexity, cryptography, and combinatorics. <b>Pseudorandom generators</b>, randomness extractors, expander graphs, error-correcting codes, hash functions.</p> <p>Prerequisite: Exposure to randomized algorithms (as in Computer Science 124), computational complexity (as in Computer Science 121), and algebra (as in Applied Mathematics 106, Mathematics 123, or Computer Science 226r).</p> <p>(b) Attached is a copy of Brian Hayes' excellent article "<b>Quasirandom Ramblings: Random numbers have a peculiar power, even when they are only pseudo or quasirandom</b>" (<i>emphasis added</i>) published in the Computing Science column in <i>American Scientist</i>, vol. 99, 2011 July-August, <a href="http://www.americanscientist.org">www.americanscientist.org</a>. Please forward to the reviewer because I suggest he read it carefully so that he may develop an understanding of the fundamental and profound difference between true randomness and pseudorandomness. The following excerpt makes the point, and the reviewer might learn a great deal by reading the article in its entirety and trying to understand it: "The concept of randomness in a set of numbers has at least three components. First, randomly chosen numbers are unpredictable: There is no fixed rule governing their selection. Second, the numbers are independent, or uncorrelated: Knowing one number will not help you guess another. Finally, random numbers are unbiased, or uniformly distributed: No matter how you slice up the space of possible values, each region can expect to get its fair share. These concepts provide a useful key for <b>distinguishing between truly random, pseudorandom, quasirandom and orderly sets</b>. True random numbers have all three characteristics: They are unpredictable, uncorrelated and unbiased. <b>Pseudorandom numbers abandon unpredictability; they are generated by a definite arithmetic rule, and if you know the rule, you can reproduce the entire sequence. But pseudorandom numbers are still uncorrelated and unbiased (at least to a good approximation).</b>" (<i>emphasis added</i>).</p> <p>(c) Turning to the reviewed paper as written, it includes extensive discussion of the nature of pseudorandomness in the context of Central Force Optimization (CFO), and it explains precisely</p> |



SDI FINAL EVALUATION FORM 1.1

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>how it works. I do agree, as the reviewer states, that "there is no computer command to assign an arbitrary value to a given variable." This remark is specious at best and ignores the extensive discussion of how a "pseudorandom" variable is included in CFO, either by calculation or by specification, and several examples are given, viz, a deterministic (i) IPD, (ii) DS shrinking, or (iii) errant probe repositioning. <b>Each of these is discussed in detail, yet the reviewer ignores this fact!</b> I consider this a remarkable failure to discharge his obligation as a "peer reviewer."</p> <p><b>2. The reviewer's statements in comment #2 are made without any basis whatsoever.</b> There is no discussion, no analysis, no reason offered for the assertions that are made, which are, in fact, entirely incorrect.</p> <p>(a) The reviewer asserts "<b>The analogy with gravity is not adequately justified...</b>" <b>Yet the reviewed paper as presently written opens as follows:</b> "CFO is a deterministic Nature-inspired search and optimization metaheuristic for an evolutionary algorithm (EA) based on gravitational kinematics [1-3]. CFO is similar to gradient-based optimization methods as discussed in detail 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 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] (<i>emphasis added</i>).</p> <p>CFO analogizes Newton's mathematically precise laws of motion and gravity, so that its underlying equations are equally precise. The algorithm locates the global maxima of an objective function defined on a decision space <math>\Omega</math> with unknown topology (landscape). CFO searches <math>\Omega</math> by flying a group of probes whose trajectories are computed from two deterministic equations of motion at a series of discrete time steps (iterations). Details of the CFO metaheuristic are in the Appendix. CFO is fundamentally different from Nature-inspired EAs whose underlying equations are inherently stochastic. Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) are examples. Their equations are formulated in terms of true random variables, and removing randomness causes these algorithms to fail completely. By contrast, CFO's equations are inherently deterministic. Every CFO run with the same setup returns precisely the same values step-by-step throughout the entire run. Nevertheless, effective implementations benefit from a pseudorandom component that enters the algorithm indirectly, not through its basic equations. Although pseudorandomness is not required in CFO, numerical experiments show that it is an important feature in effective implementations." <b>CFO has been the subject of more than two dozen peer-reviewed papers over a period of nearly six years, twenty-three of which are cited as references. Yet the reviewer makes the ridiculous statement that CFO is not "adequately justified"!</b></p> <p>The best measure of an optimization algorithm's "justification" is how well it works. <b>CFO has been tested against some very difficult problems with exceptionally good results, as an example, the following abstract from Reference [12] cited in the reviewed paper (copy attached):</b> "Inverse Transient Analysis (ITA) is a powerful approach for leak detection and calibration of friction factors in pressurized pipes. Through this method, a transient flow is initiated and pressures are measured somewhere in the system. Then, a nonlinear programming (NLP) problem with a least-squares criterion objective function is developed to minimize discrepancies between the measured and calculated pressures at measurement sites. Solving the raised NLP results in the problem's unknowns being leakage specifications and pipe friction factors. For this purpose, various optimization techniques may be utilized. <i>This issue is a major challenge for ITA-based methods.</i> The present work aims at applying the new method of Central Force Optimization (CFO) to the problem of ITA. CFO is a deterministic metaheuristic inspired by gravitational kinematics in which small objects in space are dragged by bigger ones. Herein, the concept and main structure of CFO are represented as well as of CFO. A reference pipe-network is considered to be solved using the ITA equipped with CFO. The results are then discussed compared to the previous works. <b><i>It is concluded that CFO is easy to implement, computationally efficient and has a remarkable performance in solving leak detection problem.</i></b>" (<i>emphasis added</i>). <b>The author suggests that perhaps the reviewer should read some of the CFO literature before making the bold and baseless statement that the algorithm is "not justified."</b></p> <p>(b) The reviewer asserts "<b>The analogy with gravity ... doesn't sound serious.</b>" <b>This</b></p> |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



SDI FINAL EVALUATION FORM 1.1

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>statement is laughable on its face!</b> Not "sounding serious" is hardly a rational basis of scientific criticism. Beyond this nonsense, the reviewer fails to understand that the analogy to gravitational kinematics is a <i>metaphor</i> , that is, a <i>metaheuristic</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 (please forward to the reviewer so he can learn about them). The following excerpt is relevant: "<i>A metaheuristic is a set of algorithmic concepts that can be used to define heuristic methods applicable to a wide set of different problems. In other words, a metaheuristic is a general-purpose algorithmic framework that can be applied to different optimization problems with relatively few modifications.</i> 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>).</p> <p>3. The author believes that the quality of the illustrations is more than adequate, and, in any event, that decision should be make by the journal's staff, not the reviewer.</p> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|