Response to reviewers

Title: A Steady-State NSGA-II based Multi-Objective Multicast Routing Algorithm for Optical Networks

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First of all, we would like to thank all reviewers for your detailed comments and positive recommendations. We have revised this manuscript according to all your comments. In light of our revisions, we would like to list our responses to your comments as follows.

To reviewer #1

Point 1

-Figure 2 .- The arrow for the destination node, when it is equal to 11, should be in opposite direction.

Response:

We have revised the direction of arrow for the destination node when it is equal to 11 in figure 2.

Point 2

-Page 5 .- Add space in "non-dominating layer, i.e. $F_1, \dots, F_l$ "

Response:

We have added a space in "non-dominating layer, i.e. $F_1, \dots, F_l$ " in page 5.

To reviewer #2

Point 1

First of all, the contribution "A Steady-State NSGA-II based Multi-Objective Multicast Routing Algorithm for Optical Networks" is not anonymised and seems not to follow the GECCO 2018 template.

Response:

Sorry for the mistake. We have modified the format of the article according to the template.

Point 2

the language can be improved significantly, in particular using articles like "the" and "a" in a lot of locations. One of many examples is the following sentence from page 2: "The objective vectors of solutions in THE Pareto-optimal set form THE Pareto Front (PF) in objective space."

Response:

Many thanks for the helpful comment. We have improved the language of the articles.

Point 2

A lot of abbreviations are used throughout the contribution, not all as they were introduced adequately at their first occasion. This, for instance, holds for WDM in the abstract, RWA on page 2, right column, and EMO in the remainder of the column.

Response:

Thanks for your suggestion. We have checked the whole article and make sure that all abbreviations are introduced adequately at their first occasion.

Point3

To show the quality of the new algorithm, it is compared to other multi-objective evolutionary algorithms, i.e. NSGA-II, SPEA, and MOEA/D. (I don't understand, why there is the MRWA abbreviation used for each of the algorithms since it only stands for the application at hand, right?)

Response:

The MRWA abbreviation, used for each of the algorithms, stands for the algorithm is applied to the MRWA problem.

Point4

The differences between the algorithms is mostly clear, however, it seems like for MRWA-SSNSGA-II, next to the steady-state approach, a new/different backup routing strategy, a different chromosome encoding scheme as well as different genetic operators are used. The paper is written in a style which suggests that the improvements made by the new algorithm are only due to the steady-state approach implemented in it. However, this can not be concluded from the results presented since many other changes have been incorporated as well, see above.

Response:

The improvements made by the new algorithm are not only due to the steady-state approach. A backup routing strategy has been proposed to solve the multicast routing sub-problem, and a light tree recovery mechanism has been proposed to eliminate the loop caused by the gene recombination operation, and a different chromosome encoding scheme is applied since the binary encoding scheme is inappropriate for this problem. The paper is written in a style which suggests that the results can be obtained since all above changes have been incorporated.

Point5

- which spaces are meant by "X denotes ... containing all feasible solution spaces" on the first page by the end of the right column?

Response:

This sentence has been revised as “ X denotes a decision (variable) space containing all feasible solutions”.

Point6

- Page 2, 1st paragraph (par.): “... then x^* is A Pareto optimal solution.” (replace “the” by “a”)

Response:

This sentence has been revised.

Point7

- Page 2, 2nd par.: Provide references for the algorithms you compare with.

Response:

We have added the references for the algorithms we compare with in [31,32,33].

Point8

- Add “A” in the beginning of the last par. on page 2.

Response:

We have added “A” in the beginning of the last par. on page 2.

Point9

- Also provide references for the last statement on page 2 “the steady-state EMO algorithm be computationally faster for approaching the Pareto-optimal front compared with generational evolution model.” since, in general, I doubt this.

Response:

We have added the references for the last statement on page 2 in [25].

Point10

- Page 4, first par.: omit “is” in “... EMO algorithm is computationally faster ...”

Response:

We have omitted “is” in “... EMO algorithm is computationally faster ...”

Point11

- Fig. 1 on page 4: texts in here are too small to read.

Response:

We have enlarged the texts in Fig. 1 and changed the background color of the elements in Fig. 1.

Point12

- Provide references for the decimal coding system, Sec. 4.2.

Response:

The purpose of the decimal coding system in this paper is to use a decimal number to point to a specific location in the backup routing set. This is the reason we call it the decimal coding mechanism, however it is not a new coding method. So no related references exist.

Point13

- Section 4 and subsection 4.5 share the same title?

Response:

We have revised the title of the subsection 4.5 as “The Procedure of MRWA_SSNSGA-II”.

Point14

- How is the worst solution identified in Alg. 1?

Response:

According to the identification method of the worst solution in the NSGA-II algorithm, that is to say, the solution in the last non-dominated layer is sorted according to the crowding distance, and the solution with the smallest crowding distance is identified.

Point15

- Provide references for the metrics in use, i.e. the hypervolume indicator and the coverage metric.

Response:

We have added the references for the hyper-volume indicator and the coverage metric in [34].

[34] Eckart Zitzler, Lothar Thiele. 1999. Multiobjective Evolutionary Algorithms: A Comparative Case Study and the Strength Pareto Approach. IEEE Transactions on Evolutionary Computation 3, 4 (Nov. 1999), 257-271. DOI: <https://doi.org/10.1109/4235.797969>

Point16

- Pareto fronts in Fig. 4 cannot be distinguished, these graphics need more clarity and description.

Response:

We have enlarged the texts in Fig. 4 and changed the background of Fig. 4. We have added some description of these graphics as “Compared with the solutions obtained

by other algorithms, the solutions obtained in MRWA_SSNSGA-II satisfy the requirements of convergence and diversity in terms of quantity and distribution.”

Point17

- What about statistical significance of results presented in Tab. 2 and 3? A first step could be presenting standard deviations.

Response:

We have added the standard deviations of Tab. 2. The results of C-metric in Tab. 3 can not calculate the standard deviations.

Point18

- A page break in a table is strange, please remove.

Response:

We have adjusted the structure of the article so that no break would appear in the table.

Point19

- Last but one sentence Sec. 5.3 “At the same time ... “ doesn’t make sense, is not complete.

Response:

We have deleted the sentence “At the same time ...”.

To reviewer #3

Point1

A minor detail, Figure 4 should be resized, there is enough space to use the two columns in the paper.

Response:

Thanks for your suggestion. Since there is no enough space to use, so we just enlarged the texts in Fig. 4 and changed the background of Fig. 4 to make it clearer.