

REVIEWER'S REPORT

Manuscript No.: IJAR-54354

Date: 17/10/25

Title: DC-F-MRSA: A Data Center Fault-Resilient and Fragmentation-Aware Multicast Routing Algorithm for SDM-EONs

Recommendation:

Accept as it is

Accept after minor revision.....

Accept after major revision

Do not accept (*Reasons below*).....

Rating	Excel.	Good	Fair	Poor
Originality		-		
Techn. Quality		-		
Clarity		-		
Significance		-		

Reviewer Name: DR GULNAWAZ

Detailed Reviewer's Report

The submitted manuscript presents a novel heuristic algorithm, DC-F-MRSA, designed for resilient and fragmentation-aware multicast routing in Space Division Multiplexed Elastic Optical Networks (SDM-EONs). The study extends the previously developed DC-F-RSCA framework by introducing parallel and sequential adaptive core allocation strategies to reduce Bandwidth Blocking Ratio (BBR), Crosstalk Ratio (CR), and Fragmentation Ratio (FR). The simulations conducted on COST239 and NSFNET topologies demonstrate that the proposed approach outperforms existing heuristics such as MADM Score Fit, APP-RMSCA, and FMDE-RSCA. Overall, the paper addresses an important and timely research problem in optical networking — improving resource allocation efficiency and resilience for multicast traffic in SDM-EONs.

In terms of originality, the paper makes a clear contribution by combining resilience and fragmentation-awareness in a unified multicast routing heuristic. The introduction of the SEQ and PAR strategies for adaptive core selection represents a meaningful innovation, offering a practical balance between fragmentation minimization and crosstalk mitigation. However, the authors should emphasize more clearly how their algorithm differs structurally from existing methods such as FMDE-RSCA and APP-RMSCA. A comparative table outlining the key differences in algorithmic flow and decision criteria would help highlight the novelty of DC-F-MRSA.

From a technical standpoint, the proposed methodology is conceptually strong and consistent with the network model assumptions. The cost function formulation and the integration of adaptive core selection are well thought out. However, the description of the algorithm could be made more transparent by

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including pseudo-code or a flow diagram. The paper would also benefit from a clearer justification of the weight factors used in the cost function and a detailed explanation of how trade-offs between fragmentation and crosstalk are managed. Furthermore, the simulation setup should be described in greater detail, including parameters such as the number of cores per fiber, modulation formats, load distribution, and traffic models. Including a comprehensive table of simulation parameters would enhance reproducibility.

The organization and clarity of the paper are generally good. The manuscript follows a logical flow from introduction to conclusion, and the results are presented coherently. However, the paper would benefit from minor linguistic and formatting improvements to enhance readability. Some typographical inconsistencies—such as missing spaces, capitalization errors, and figure referencing (e.g., “as shownFigure 5”)—should be corrected. The authors are encouraged to perform a thorough language and formatting revision to ensure uniformity in figure captions, variable notation, and abbreviations throughout the paper.

The results and discussion sections are convincing and well-supported by the simulation data. The inclusion of two different topologies (COST239 and NSFNET) adds strength to the findings. The results effectively demonstrate that DC-F-MRSA achieves lower BBR, CR, and FR compared to existing methods. Nevertheless, the authors should consider including statistical analyses, such as error margins or standard deviations, to substantiate the reliability of the simulation outcomes. Additionally, a computational complexity analysis comparing the SEQ and PAR strategies would be beneficial in discussing the scalability and runtime performance of the proposed approach under dynamic network conditions.

The references cited in the manuscript are current and relevant, covering major studies from 2019 to 2023. The literature review demonstrates good awareness of the state of the art in SDM-EON research. However, some citations could be better integrated within the discussion to show how the proposed algorithm addresses the limitations of existing models. The authors should consider elaborating on how previous methods such as those by Yousefi et al. (2020) or Paira et al. (2020) differ in terms of resilience and fragmentation handling compared to the proposed model.

Figures in the paper are generally clear and effectively support the discussion. However, the captions could be made more descriptive by summarizing the trends shown rather than simply restating the figure title. It would also be helpful to include details such as simulation conditions and key parameters directly in the captions. Ensuring consistency in axis labels, units, and legend formats would improve the overall visual presentation of the results.

The conclusion effectively summarizes the contributions of the study and aligns well with the paper's objectives. The authors also present a well-defined future research direction, proposing the use of machine learning models for traffic prediction, real-time testbed validation, and energy consumption analysis. These points demonstrate a forward-thinking approach and show potential for extending the current research toward practical applications in programmable optical networks.

In summary, this paper presents a technically sound and relevant contribution to the domain of resilient and fragmentation-aware multicast routing in SDM-EONs. The proposed DC-F-MRSA algorithm is innovative and demonstrates clear performance improvements through simulation results. However, certain aspects such as detailed parameter justification, algorithmic explanation, and clarity of presentation should be improved. Therefore, I recommend the manuscript for **acceptance with minor**

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revisions. Addressing the minor technical and editorial suggestions mentioned above will significantly enhance the overall quality and impact of the paper.