

# Major Reviews from IEEE-TAC Reviewers

## Reviewer 4

- “The improvements compared to the existing results are also unclear, which makes it difficult to evaluate the contribution of this article.”
- “There are some language and grammar issues in this paper and the authors need to revise their paper properly.”

## Reviewer 5

- “The paper discusses contributions and motivation in multiple sections, but these points are not clearly articulated or cohesively presented. To improve readability and impact, I recommend reorganizing the introduction to explicitly highlight the key contributions.”
- “Algorithm (23) is presented in isolation without sufficient explanation or context. The authors should provide a detailed discussion immediately after introducing the algorithm, including the intuition behind its design, a clear comparison with existing methods to highlight key differences, and specific improvements or advantages over traditional approaches.”
- “The paper lacks a detailed theoretical analysis of the proposed algorithm’s convergence performance compared to existing methods.”
- “The conditions in Assumption 2 seem restrictive. Can they be relaxed, as in Ref. [34]? If not, please provide a detailed explanation.”
- “The need for Assumption 1 should be justified. Can the framework be extended to more general cases?”
- “The Lagrangian function (15) for the RO problem (4) appears to be straightforward, raising questions about the necessity of the lengthy and intricate analysis preceding it. The authors should assess whether the detailed derivation in the earlier part of Section IV is essential.”
- “The introduction is lengthy and lacks a coherent structure. Please revise it to emphasize the advantages of the proposed method, particularly its ability to operate without prior problem modeling.”

- “The techniques from Ref. [22] used in the simulation appear outdated and may not reflect the current advancements in the field. To strengthen the comparative analysis, it is recommended to include state-of-the-art algorithms in the evaluation.”

## Reviewer 6

- “My concern lies in the motivation behind the problem formulation (4). Does it offer any advantages compared to formulation (3)? The authors should emphasize the main reason for introducing (4), beyond merely presenting it as a more general version of (3).”
- “In equation (10), to derive the Lagrangian function, the authors introduce  $\lambda_i$  as multipliers. However, one could instead consider multipliers of the form  $\gamma_i := c_i + \lambda_i$ , which would reduce to the Lagrangian function of formulation (3). Therefore, I still do not see the novelty or specific role of the  $c_i$  terms.”
- “In formulation (2), the authors take the maximum over the constraint functions, which significantly increases the problem’s complexity compared to the classical robust optimization problem (1). Specifically, if the constraint functions are smooth, taking the maximum introduces non-smoothness, making the problem harder to solve than formulation (1). It would be helpful for the authors to justify this modeling choice.”
- “Lemma 1 is a well-known result, or am I missing something? since, Definition 1 for convex problems seems to be stating the KKT conditions, which are then referred to as a saddle point condition, when certain constraint qualifications hold (e.g., Slater’s condition).”
- “Assumption 3 states that  $c_i > 0$ , which implies that the problem formulation presented in (2) is not recovered. Since this assumption is introduced for technical reasons, it may need to be relaxed to ensure consistency with formulation (2).”

## Reviewer 10

- “The current manuscript has several important limitations in terms of technical depth and presentation, which make it unsuitable for publication as a full research article.”
- “The authors should consider re-submitting the work in the form of a technical note rather than a full research article.”
- “The abstract is overly long, and the writing style—both in the abstract and throughout the paper—could benefit from greater clarity and conciseness. In several places, long sentences obscure the intended message, making the content harder to follow.”
- “This is while the existing solutions such as the robust counterpart and scenario-based random sampling assume that the problem formulation is completely known a priori.”

- “The reformulation approach to solving the RO problem, which is often a challenging, albeit usually convex, optimization problem, has the deficiency of suffering from case-by-case scenarios depending on the specific form of the uncertainty constraint and the specific form of the uncertainty set.”
- “The novelty of Lemma 1 and its proof is unclear. From the reviewer’s point of view, it appears to reflect a standard saddle point property within the context of Lagrangian duality. To strengthen the contribution, it would be helpful to clearly explain what is new in this result and how it differs from classical formulations.”
- “Regarding Assumption 3, the strict positivity of the  $C$  parameter may be overly rigid for practical modeling purposes.”
- “The requirement imposed in Corollary 1 is quite strong and may pose challenges in both theoretical analysis and practical implementation.”
- “In the presented examples, the actual robust optimization setting—particularly with scenario-based uncertain constraints—is not fully addressed. Incorporating such scenarios would strengthen the practical relevance of the examples.”

## Combined Major Reviews by Section

### Abstract

- **Reviewer 10:** “The abstract is overly long, and the writing style—both in the abstract and throughout the paper—could benefit from greater clarity and conciseness. In several places, long sentences obscure the intended message, making the content harder to follow.”

### Introduction

- **Reviewer 4:** “The improvements compared to the existing results are also unclear, which makes it difficult to evaluate the contribution of this article.”
- **Reviewer 5:** “The paper discusses contributions and motivation in multiple sections, but these points are not clearly articulated or cohesively presented. To improve readability and impact, I recommend reorganizing the introduction to explicitly highlight the key contributions.” Also: “The introduction is lengthy and lacks a coherent structure. Please revise it to emphasize the advantages of the proposed method, particularly its ability to operate without prior problem modeling.”
- **Reviewer 10:** “The reformulation approach to solving the RO problem, which is often a challenging, albeit usually convex, optimization problem, has the deficiency of suffering from case-by-case scenarios depending on the specific form of the uncertainty constraint and the specific form of the uncertainty set.”

## Problem Formulation and Assumptions

- **Reviewer 5:** “The conditions in Assumption 2 seem restrictive. Can they be relaxed, as in Ref. [34]? If not, please provide a detailed explanation.” Also: “The need for Assumption 1 should be justified. Can the framework be extended to more general cases?”
- **Reviewer 6:** “My concern lies in the motivation behind the problem formulation (4). Does it offer any advantages compared to formulation (3)? The authors should emphasize the main reason for introducing (4), beyond merely presenting it as a more general version of (3).” Also: “In formulation (2), the authors take the maximum over the constraint functions, which significantly increases the problem’s complexity compared to the classical robust optimization problem (1).” And: “Assumption 3 states that  $c_i > 0$ , which implies that the problem formulation presented in (2) is not recovered.”
- **Reviewer 10:** “Regarding Assumption 3, the strict positivity of the C parameter may be overly rigid for practical modeling purposes.”

## Algorithm and Dynamics (Section V)

- **Reviewer 5:** “Algorithm (23) is presented in isolation without sufficient explanation or context. The authors should provide a detailed discussion immediately after introducing the algorithm, including the intuition behind its design, a clear comparison with existing methods to highlight key differences, and specific improvements or advantages over traditional approaches.”

## Theoretical Analysis and Convergence

- **Reviewer 5:** “The paper lacks a detailed theoretical analysis of the proposed algorithm’s convergence performance compared to existing methods.”
- **Reviewer 6:** “Lemma 1 is a well-known result, or am I missing something? since, Definition 1 for convex problems seems to be stating the KKT conditions, which are then referred to as a saddle point condition, when certain constraint qualifications hold.”
- **Reviewer 10:** “The novelty of Lemma 1 and its proof is unclear. From the reviewer’s point of view, it appears to reflect a standard saddle point property within the context of Lagrangian duality.” Also: “The requirement imposed in Corollary 1 is quite strong and may pose challenges in both theoretical analysis and practical implementation.”

## Lagrangian Analysis (Section IV)

- **Reviewer 5:** “The Lagrangian function (15) for the RO problem (4) appears to be straightforward, raising questions about the necessity of the lengthy and intricate analysis preceding it.”

- **Reviewer 6:** “In equation (10), to derive the Lagrangian function, the authors introduce  $\lambda_i$  as multipliers. However, one could instead consider multipliers of the form  $\gamma_i := c_i + \lambda_i$ , which would reduce to the Lagrangian function of formulation (3). Therefore, I still do not see the novelty or specific role of the  $c_i$  terms.”

## Simulations and Examples

- **Reviewer 5:** “The techniques from Ref. [22] used in the simulation appear outdated and may not reflect the current advancements in the field. To strengthen the comparative analysis, it is recommended to include state-of-the-art algorithms in the evaluation.”
- **Reviewer 10:** “In the presented examples, the actual robust optimization setting—particularly with scenario-based uncertain constraints—is not fully addressed. Incorporating such scenarios would strengthen the practical relevance of the examples.”

## Overall Presentation and Writing

- **Reviewer 4:** “There are some language and grammar issues in this paper and the authors need to revise their paper properly.”
- **Reviewer 5:** Multiple presentation issues noted throughout.
- **Reviewer 10:** “The writing style—both in the abstract and throughout the paper—could benefit from greater clarity and conciseness.”

## Publication Recommendation

- **Reviewer 4:** Implicitly suggests major revision needed.
- **Reviewer 5:** Requires significant revisions.
- **Reviewer 6:** Requires clarification of contributions.
- **Reviewer 10:** “The authors should consider re-submitting the work in the form of a technical note rather than a full research article.”