MATHAUDIT / PUBLISHED-PAPER REPORT

Correctness, proof completeness, and novelty audit

Applications of Siegel's Lemma to a system of linear forms and its minimal points

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Scope	Statements, proofs, and novelty

Important limitation. AI-generated analysis. This report is not a correctness certificate or a substitute for expert scrutiny.

SUMMARY

01	Statements	Contains unsupported statements
02	Proofs	Contains incorrect or incomplete proofs
03	Novelty	No non-novelty findings

Statements

Contains unsupported statements The attributed one-form ratio theorem, the new short-vector bounds, and the linear-independence criteria are supported after local notation corrections. The generic form of Theorem 2.4 is recoverable from a corrected determinant estimate, and its exact one-dimensional specialization used by the focal paper is independently supported; the theorem's stated reduction for arbitrary h is not verified because the manuscript gives only one sentence for that substantive step.

Theorem 2.1: The Marnat-Moshchevitin ratio bound is accurately recorded

arXiv:1904.06121v4, p. 3, Theorem 2.1

Correctly treated as an attributed result

For one linear form, the stated lower bound $w(\Theta)/\widehat{w}(\Theta) \geq G_{1,n}$ and its defining polynomial agree with the independently audited Marnat-Moshchevitin theorem. The single occurrence of $\widehat{\omega}$ in the definition of $G_{1,n}$ is a notation slip for the paper's $\widehat{w}$.

Theorem 2.4, equation (6): The arbitrary-subspace reduction is not established in the manuscript

arXiv:1904.06121v4, pp. 5-6 and 27, Theorem 2.4, equation (6), and Annex

Not able to verify in its full stated generality

After correcting the determinant factors, the Annex proves the generic case $h = m + n$. For general h, however, it only says that one can reduce to an $m' \times n'$ matrix by considering $\mathscr{L}_\Theta \cap \mathscr{S}_\Theta$. It does not construct the rational lattice coordinates, prove equivalence of the restricted approximation norms and exponents, or show that the needed consecutive-minimal-point property survives. No complete repair of that general reduction was verified.

Theorem 2.4, marked specialization: The rational-dimension ratio estimate used by the focal paper is correct

arXiv:1904.06121v4, pp. 5-6, Theorem 2.4 and equation (6), with $n' = 1$; focal Proposition 3.3

Correct for the imported specialization

For a vector whose coordinates have rational dimension $r \geq 3$, a rational change of coordinates reduces to a totally irrational vector in dimension $r - 1$ without changing the ordinary or uniform simultaneous exponents. The audited Marnat-Moshchevitin one-form theorem then gives exactly $\omega/\widehat{\omega} \geq G_r$. Thus the statement imported by the focal Irrational Subspaces paper remains supported even though the Annex does not prove the whole arbitrary-h formulation. No external paper beyond Marnat-Moshchevitin is materially needed for this exact marked claim.

Theorems 3.1 and 3.3: The short-vector bounds follow, with one reciprocal typo in an equality clause

arXiv:1904.06121v4, pp. 7-9 and 18-21, Theorems 3.1 and 3.3 and proofs

Correct after a local correction

Siegel's Lemma applied to a short lattice vector and a maximal independent subfamily yields the announced bounds in terms of $1 + \tau + \cdots + \tau^{h-2}$ and the $h = 3$ specialization. In the last equality clause of Theorem 3.3, the printed limit $\widehat{w}/w$ must be $w/\widehat{w}$: the logarithmic height ratio is at least one, and the preceding inequalities force the latter quotient.

Theorems 4.1-4.6: The linear-independence criteria are supported after mechanical formula repairs

arXiv:1904.06121v4, pp. 10-17 and 20-27, Section 4 and proofs

Correct after local corrections

The determinant relation among a maximal independent subfamily, Siegel's Lemma, and the growth and error quotients give the stated independence thresholds. In equation (39), the displayed comparison of the exact and simplified thresholds has the wrong direction: the simplified sufficient threshold is the smaller one and must appear first. The main condition using the exact threshold remains correct. The extra parenthesis in Theorem 4.6 and a few missing or doubled local symbols are uniquely repairable and do not change the criteria.

Proofs

Contains incorrect or incomplete proofs The Siegel-Lemma arguments in Sections 3-5 are substantively correct after local notation repairs. The Annex proof of Theorem 2.4 is incorrect as printed because it swaps the numbers of height and error factors, and its extension from the generic case to arbitrary h is only asserted.

Proof of Theorem 3.1: The short-vector determinant argument has the required exponent balance

arXiv:1904.06121v4, pp. 18-21, Section 5.3

Correct and complete after notation correction

A maximal independent subfamily together with the prescribed short vector gives an integer relation whose primitive coefficient vector is bounded by Siegel's Lemma. Pairing that relation with the extended matrix controls the maximal coefficient from below; substitution of the uniform error estimate yields equation (48), and Lemma 5.1 turns the intervening growth ratios into the claimed geometric sum. The isolated a_t in the linear identity must be a_1, as the adjacent indexing makes clear.

Proofs of Theorems 4.1-4.6: The consecutive-minimal-point criteria close after local symbol repairs

arXiv:1904.06121v4, pp. 20-27, Sections 5.4-5.5

Correct and complete after notation correction

Assuming dependence, a maximal independent subfamily supplies a primitive integer relation. The coefficient bound and the separation between consecutive errors force inequalities incompatible with each theorem's hypothesis. The proof's doubled exponent in the Theorem 4.2 estimate, a missing floor bracket in Theorem 4.3, and the unmatched parenthesis in Theorem 4.6 are mechanical: the following algebra already uses the uniquely corrected forms.

Annex determinant estimate: The numbers of height and error columns are interchanged

arXiv:1904.06121v4, p. 27, first determinant estimate in the Annex

Incorrect as written · verified repair for the generic case

There are n coordinate columns bounded by heights and m transformed y-columns bounded by errors. The printed product instead contains m height factors and n error factors. It must be

$$\prod_{j=m}^{m+n-1} \|z_{t+j}\| \prod_{j=0}^{m-1} \|\Theta^E z_{t+j}\|,$$

not the product starting the height block at $t+n$. With this swap, assuming every consecutive growth ratio is below G gives the coefficient $-\widehat{w}\sum_{j=1}^{m-1} G^{-j} + 1 - \widehat{w} + \sum_{j=1}^{n-1} G^j = P_{m,n}(G)$, so the generic conclusion follows. The printed range $j \in \{t+1, \dots, t+n-2\}$ must likewise range over the eligible consecutive ratios in the full block; as printed it is empty when $n = 2$.

General-h reduction in the Annex: The passage to the restricted system is only asserted

arXiv:1904.06121v4, p. 27, final paragraph of the Annex

Incomplete as written · no verified full repair supplied

The one-sentence instruction to consider $\mathscr{L}_\Theta \cap \mathscr{S}_\Theta$ omits the lattice-coordinate construction and the invariance statements needed to replace the original problem by an $m' \times n'$ minimal-point system. Those obligations are not merely a change of notation, so the full form of Theorem 2.4 is not proved here. For the exact $n' = 1$ claim imported by the focal paper, the independent rational-coordinate reduction followed by the audited Marnat-Moshchevitin theorem supplies the needed result.

Novelty

No non-novelty findings No non-novelty findings.

Exact-source disclosure

The cited journal version of record was not accessible to the auditor. This audit therefore evaluated only the explicitly linked arXiv version. It does not claim to audit the inaccessible version of record. The Combinatorics and Number Theory version of record was available only by subscription or purchase and could not be retrieved in this audit session; the exact arXiv v4 manuscript was reviewed and is not represented as the version of record.

Sources checked

1. arXiv:1904.06121v4 · explicit fallback for inaccessible version of record

APPENDIX

Audit instructions

You are a mathematical auditor. Evaluate only the correctness of the paper's central statements, the correctness and completeness of its proofs, and evidence-backed non-novelty. Do not make editorial comments or evaluate importance, exposition, style, or suitability for publication. Keep the report neutral, precise, and professional.

PART 1 — CORRECTNESS OF THE MAIN STATEMENTS

Identify the paper's central statements and assess each one separately using exactly one of these outcomes:

- Correct: the statement has a correct, verifiable proof; or, despite a defect in the printed proof, you can give a fully verified repair or independent proof.
- Incorrect: you can give strong formal evidence that the statement as written is false, preferably a counterexample or a complete contradiction.
- Not able to verify: the supplied proof does not establish the statement, and you can neither supply a fully verified proof nor disprove it.

For every adverse or unverified outcome, restate the exact claim and hypotheses, identify its location in the reviewed version, and give the decisive reasoning. Do not infer that a theorem is false merely because its printed proof is defective.

Assign the overall statements status by the following priority:

1. Contains wrong statements, if at least one central statement is Incorrect.
2. Contains unsupported statements, if no central statement is Incorrect but at least one is Not able to verify.
3. Correct, if every central statement is Correct, apart from any typographical or minor formal findings allowed by Part 4.

PART 2 — CORRECTNESS AND COMPLETENESS OF THE PROOFS

Audit the proofs of the central statements and every material internal or cited input on which they depend. For each proof or proof segment, use the narrowest supported outcome:

- Correct and complete: every substantive step is verifiable and no case or crucial nontrivial step is missing.
- Incorrect as written: a displayed calculation, inference, lemma, or cited application is formally false or inapplicable.
- Incomplete as written: a necessary substantive step or case is missing, even though no explicit contradiction has been proved.
- Not able to verify: the available paper and sources are insufficient to decide whether the step is valid.

Do not flag omitted routine details, compressed arguments, or "analogously" steps when the omitted reasoning is recoverable and correct. For every defect, identify its smallest exact location, explain its downstream dependency, and classify any proposed repair as one of:

- Verified repair: supply enough reasoning to verify that the repair works throughout every affected use.
- Plausible repair only: describe the possible repair but do not treat it as established.
- No repair supplied.

Assign the overall proofs status by the following priority:

1. Contains incorrect or incomplete proofs, if at least one proof is Incorrect as written or Incomplete as written.
2. Contains unverified proofs, if there is no proved incorrectness or incompleteness but at least one material proof is Not able to verify.
3. Correct, if all audited proofs are Correct and complete, apart from any typographical or minor formal findings allowed by Part 4.

PART 3 — NOVELTY OF THE MAIN STATEMENTS

This is a one-sided, evidence-only check. Evaluate only central results. Report a result only when a verifiable primary source, publicly available before the earliest public version of the paper that contains the result, proves the same statement up to a change of notation, or when the result follows directly and immediately from such an earlier theorem.

For each non-novelty finding, provide the earlier source, its public date, the exact theorem or proposition, and an explicit hypothesis-and-conclusion mapping. A later source cannot establish non-novelty. Do not flag a result merely because an easier proof exists or because it follows through a nontrivial argument. Do not flag a result that the paper itself explicitly presents as known, a survey item, or an alternative proof.

Mention only statements that meet this non-novelty threshold. Say nothing about statements for which no such evidence was found: do not certify novelty, list unsuccessful searches, or add statement-level "no prior source found" entries. If the list is empty, the section may say only "No non-novelty findings."

PART 4 — TECHNICAL AND EVIDENTIARY RULES

1. Criticism must never be overstated. Call a statement incorrect, a proof incorrect or incomplete, or a result non-new only when strong formal evidence supports that exact judgment. Otherwise use Not able to verify where that outcome exists, or remain silent in the novelty section.

2. Review a specified paper version. Give exact page, theorem, equation, or proof locations; restate relevant quantifiers and hypotheses; and check domains, endpoints, parameter ranges, constants, and dependencies explicitly. Apply a defect only to the regimes and downstream results that actually depend on it.

3. Immediate-consequence closure: when deciding whether a conclusion is supported, treat the argument as including every immediate formal consequence of facts established earlier in the paper and available at that point. An immediate formal consequence is a local, mechanically checkable inference using only definitions already in force, elementary logic, direct substitution or renaming, weakening of an inequality or set inclusion, or a monotonicity or symmetry property explicit in a definition or already proved.

4. Such an inference must introduce no new lemma, estimate, construction, case analysis, limiting or compactness argument, external result, or new issue of uniformity or parameter dependence. Check the direction of monotonicity and the dependence of every threshold or constant explicitly. Do not exchange pointwise and uniform conclusions, change exceptional sets, interchange quantifiers or limits, or extend an endpoint under this rule unless the required fact was already established.

5. If the claimed conclusion follows after immediate-consequence closure, it is fully supported. Do not report a gap, unsupported statement, minor formal correction, or recommendation to add an explanatory sentence, and do not mention the suppressed item in the report. This suppression does not apply to a genuine typographical error as defined below, because a typo is a literal notation defect that still requires a textual correction. For example, if $P(delta)$ is proved for every sufficiently small $delta > 0$ and P is immediately monotone in the required direction, then the claim that $P(delta)$ holds for every $delta > 0$ requires no correction; the omitted monotonicity step is exposition rather than an audit finding.

6. Immediate-consequence closure permits reconstruction of an omitted inference; it does not permit silent alteration of the printed domain, hypotheses, or quantifiers of an intermediate statement later invoked outside its stated scope. If formal validity requires changing the text of that statement or its stated range, report the appropriate finding even when the repair is easy. Thus a result stated only for $t > 0$ and subsequently applied at $t = 0$ remains a formal scope mismatch unless the endpoint case was separately established before the application.

7. Apply this mandatory gate before recording any adverse, unverified, typographical, or minor formal finding: (a) identify the exact assertion or inference alleged to be defective; (b) reconstruct the strongest conclusion following from the preceding argument after all admissible immediate formal consequences are added; (c) identify the specific defect that remains — a formally demonstrated falsehood, a concrete nontrivial unresolved proof obligation, or a genuine domain, hypothesis, quantifier, or notation mismatch requiring a textual correction; and (d) state the evidence and minimal repair. If no specific defect remains, or if the only possible addition would be explanatory, suppress the finding entirely. Use Not able to verify only when a precise, nontrivial unresolved obligation can be identified.

8. A typographical error is an incorrect symbol, index, exponent, sign, variable name, or notation mismatch whose unique intended correction is mechanically determined from the surrounding text and does not alter the mathematical argument. Report it in yellow as Typo, with the printed text, correction, exact location, and reason it is harmless. It does not lower an overall status.

9. A minor formal correction is a boundary, endpoint, or displayed parameter-range defect that can be repaired consistently in every affected statement by a local change, without a new argument, without invalidating any related result or application, and without creating another substantive defect. Report it in yellow as Minor formal correction, with the same details. It does not lower an overall status.

10. Do not use either minor category if more than one materially different repair is possible; if the repair changes the substance or scope of a central result; if an excluded case is used later; if the correction fails to propagate consistently; or if a new mathematical idea is required. In such cases use the strongest substantive classification actually supported by evidence.

11. Write every mathematical expression as valid, compilable LaTeX. Use `$...$` for inline mathematics and `$$...$$` for displayed mathematics, with balanced delimiters and braces. Do not leave raw LaTeX commands outside math delimiters.

12. Separate theorem truth from the correctness of the printed proof. A theorem can be Correct in Part 1 because of a fully verified independent proof while its printed proof is adverse in Part 2. Conversely, a defective proof alone never licenses an Incorrect theorem classification.

Organize the report under Parts 1–3 and apply Part 4 throughout. Do not add editorial commentary, scores, rankings, recommendations, or a list of suppressed observations.

END OF REPORT