Adversarial Review of OMEGA Paper VIII

Mathematical proofs and publication package

Prepared for Matthew Alan Newman

19 September 2026

1 Publication decision

The corrected manuscript and companion are suitable for release as a mathematical technical preprint. I found no counterexample or proof-breaking gap in the 29 named results. The submitted numerical companion contained two reproducible defects that deserved correction before release. Those defects are now corrected, the original and revised results are retained, and the existing exact certificate is unchanged. The supplied DOI, **10.5281/zenodo.22848213**, has been added to the manuscript and source package.

This verdict concerns the explicit results and their stated hypotheses. It does not establish journal acceptance, priority over all prior literature, formal verification of the software, or a general result for Navier–Stokes with arbitrary prescribed force. The paper itself appropriately distinguishes those matters. Its strongest publication case is as a self-contained account of specific representation maps, proofs of their meaning, a localized transport construction, and reproducible finite certificates.

The audit read the complete mathematical manuscript, examined the active source, reran the released checks, independently recomputed the central arithmetic and symbolic identities, challenged all 18 interface operations with mutated outputs, and inspected the PDF and rendered Word editions. The new audit was also prepared with ChatGPT assistance. A separately written calculation here is not an independent institutional peer review.

Finding	Severity in submitted package	Resolution
Flat-step derivative becomes nonfinite near zero	Moderate numerical defect	Corrected with underflow-safe tails and regressions
Strong anisotropy can destroy volume preservation in binary64 samples	Moderate numerical defect	Added an explicit conditioning guard and documented its limits
Abstract can suggest arbitrary compact-set motion	Minor scope ambiguity	Restricted the wording to the stated deformation family
Full reproduction commands use dependencies beyond the standard library	Minor documentation omission	Clarified that integrated tests and export also require NumPy
Core arithmetic, geometric and analytic statements	No proof-breaking issue found	Retained unchanged

2 Inventory and version reconciliation

The three attachments are editions of one manuscript plus its reproduction archive. They are not three independent mathematical papers. The archive contains 85 files, including its top-level manifest. Its 84 listed file hashes all matched. The nested companion manifest likewise matched all 73 listed files, with no missing entries. The archived Word file is byte-identical to the separately uploaded Word file.

The uploaded PDF and archived PDF have different file hashes but identical extracted text and identical rendered pixels on all 34 pages at the audit's comparison resolution. The uploaded PDF contains an embedded object named

`Content Credentials`; the archived PDF does not. The difference is not a different mathematical version. The original Word edition renders to 35 pages and contains 893 native equation objects. Its comments container is empty, and no tracked insertions or deletions were found.

The following hashes identify the inputs that were reviewed.


```
Uploaded PDF
a5f3e3e9c2df963383eadd4600542a497974e527e79f4a3a1fc16e5a43bc9235

Uploaded Word document
482e77031e12c613ccfa4d86f7a1c0c2ced4a6f6ac764132f909811e6ddc2792

Uploaded source archive
5e47b7d580647d38f9ced5472b21dbddf4bca0f01213ef3f9618ed6f286272ef

Archived PDF
8c250cdff44e82e0511ed140862cec2e3d24a622b9c67cd9198bc73c9d63a34e
```


The working audit date follows the manuscript's 19 September 2026 date. Runtime timestamps can cross midnight UTC. The original uploaded bytes were retained separately during the review; revised files have new manifests and a change record.

3 Result by result mathematical review

"Supported" in the following tables means that the stated argument was checked for logical validity under its hypotheses and that no fatal gap was found. A finite execution alone is not the reason for accepting an infinite-domain or analytic theorem.

3.1 Geometry and exact arithmetic

Result	Adversarial question and disposition
Proposition 2.1	Does the scalar retain placement or scale? No, and the paper says so. The selected outer lengths equal $a\varphi$ and the selected semicircle length equals $a\pi$. The labeled seed sum and difference recover the frame at positive scale. Supported.
Proposition 2.2	Can an injective encoder recover distinctions already lost by an observation? The equivalence of fibers correctly rules this out. Supported.
Proposition 3.1	Do negative real coordinates or discarded residuals invalidate the coordinate claim? The floor convention gives the correct half-open residual interval for every real input. The paper explicitly retains a real residual and distinguishes reset dynamics. Supported.
Theorem 3.2	Are range bounds enough for a reverse ledger? No: divisibility, order and the terminal state are needed. The theorem includes them. The parameter interval is both necessary and sufficient. Supported.
Lemma 4.1	Could an unreduced separator defeat the denominator bound? Reduction only decreases its denominator; the determinant-one argument therefore still applies. Endpoint strictness is correct. Supported.
Theorem 4.2	Is the claimed first disagreement only a numerical estimate? No. Rational enclosures, the unimodular separator, and an independently implemented complementary floor-sum recurrence reproduce the boundary. Supported.
Theorem 5.1	Do periodicity or equality endpoints fail remotely? The ceiling identity and the residue condition handle zero and nonzero residues correctly. The least-period argument uses the reduced density. Remote endpoints were checked. Supported.
Corollary 5.2	Is the discrepancy bound non-strict at an endpoint? It is the difference of two fractional parts and has absolute value strictly less than one. Supported.
Theorem 5.3	Are nested root preimages incorrectly called a partition? No. The disjoint first-hitting layers are separated from the nested preimages. The integer endpoint recurrence is correct. Supported.

Result	Adversarial question and disposition
Theorem 6.1	Does the ledger reconstruct arbitrary shapes? No. It reconstructs the defined marked scale family with retained h, placement and construction rules. The zero convention is explicit. Supported.
Theorem 6.2	Does the Hausdorff equality need convexity or a star-shaped set? No. A maximal-norm point gives the matching lower bound for any nonempty compact template. The strict rounding bound is restricted to $n \geq 1$. Supported.

The integer checks reproduced the depth histogram

$$[1, 2, 6, 18, 53, 156, 459, 1350, 3971, 11681, 15071],$$

the full ordered child-fiber signature table, the clipped terminal fiber, and the maximal parameter interval

$$\left[\frac{4196}{12343}, \frac{7039}{20706}\right).$$

The assertion that F is not a strict contraction in the usual integer metric is correct: $F(2) = 0$ and $F(3) = 1$. Strict integer descent, rather than a Lipschitz contraction assertion, proves termination.

3.2 Transport and fluid realization

Result	Adversarial question and disposition
Proposition 7.1	Does the deformation preserve the claimed quadratic and cubic relations? $K^2 = I$, $K^T H + HK = 0$ and the two eigen-observations verify them. The axial multiplier cancels planar area change. Supported.
Proposition 7.2	Is the orientation-reversing one-step matrix wrongly realized by a plane-preserving flow? No. The paper realizes its square and correctly uses a relative schedule exponent. Supported.
Theorem 7.3	Is pressure able to absorb the affine acceleration? Yes: B and $\dot{B} + B^2$ are symmetric, $\operatorname{tr} B = 0$, and $\Delta(BX) = 0$. The infinite-energy qualification is necessary and present. Supported.
Theorem 7.4	Does multiplying velocity by a cutoff destroy incompressibility? The construction uses a localized vector potential, not a bare velocity cutoff. Compactness of the trajectory tube permits a cutoff equal to one on a neighborhood. Supported for the stated family and schedules.
Corollary 7.5	Can the same nonzero compactly supported velocity use the same force at two viscosities by changing pressure? The integrated difference equation rules this out. The work and dissipation identities are correct. Supported.
Theorem 7.6	Does localization survive outside three dimensions? The antisymmetric tensor divergence gives the required identity in every finite $m \geq 3$. Independent nonradial symbolic checks in dimensions 3, 4, 5 and 8 corroborated the general proof. Supported.

The localization identity is

$$u = \left(\chi + \frac{X \cdot \nabla\chi}{m}\right) BX - \frac{BX \cdot \nabla\chi}{m} X.$$

Its divergence vanishes for traceless B. For the specified generator and homogeneous invariant, direct differentiation gives

$$u \cdot \nabla J_m = -J_m (BX \cdot \nabla\chi).$$

Thus the invariant is guaranteed on the selected core trajectories, not throughout the transition region. The manuscript explicitly makes this distinction.

The prescribed force is the residual of the momentum equation after constructing u and p. This is a valid existence construction. It is not a solution operator for an independently prescribed force, a proof of unforced global regularity, or a physical derivation of the forcing from the marked shape. No such stronger result should be attached to this paper's DOI.

3.3 Integration and exact field observations

Result	Adversarial question and disposition
Theorem 8.1	Why do finitely many checks imply all real-coefficient polynomials? Monomial spanning and linearity supply that implication. The normalized sphere-moment formula is correct. Supported.
Theorem 8.2	Does symmetry omit a degree-five monomial or hide a degree-six success claim? The stated symmetry classes exhaust the required even monomials; all 56 were independently evaluated. The sixth-degree failure is exact. Supported and appropriately classical.
Theorem 8.3	Do the constants confuse mean squared speed with kinetic energy? The angular formulas and the ball integral include the correct factors. The velocity second moment is properly distinguished from Cauchy stress. Supported.
Theorem 8.4	Could sign-changing numerators invalidate the ratio bound? The four-corner bound remains valid with a strictly positive denominator lower bound. The finite-cell theorem is sound, but it does not replay the absent 4096-cell payload. Supported at the stated conditional scope.
Proposition 8.5	Does the gamma-function normalization generalize correctly? Yes, including zero total degree, odd powers and arbitrary finite dimension. Supported.
Theorem 8.6	Does localization necessarily require degree six for total energy? The sphere identity reduces squared speed to degree four, while a component square can retain degree six. The exact obstruction and energy coefficient were checked. Supported.

The independent twelve-node calculation yielded

$$\mathcal{Q}(z^6) - \int_{S^2} z^6 \, d\sigma = \frac{2}{15} - \frac{1}{7} = -\frac{1}{105}.$$

For the stated shell example, multiplying by the coefficient $9r^2t^2$ gives

$$\mathcal{Q}(u_z^2) - \int_{S^2} u_z^2 \, d\sigma = -\frac{3}{35} r^2 t^2.$$

The total angular energy formula is also correct:

$$\int |u(r\omega)|^2 \, d\sigma_{m-1} = r^2 \operatorname{tr}(B^2) \left(\frac{b^2}{m} + \frac{2bt + t^2}{m+2} \right).$$

The remaining radial integral is not certified merely by this angular exactness. The paper already states that limitation.

3.4 Fields and composition

Result	Adversarial question and disposition
Proposition 9.1	Does the finite-coordinate field accidentally include every point on a continuous arc? The theorem is explicitly limited to the finite marked-coordinate data. The root-of-unity argument and relative algebraic-closure argument justify the field intersection. Supported.
Proposition 9.2	Is the spiral map globally invertible, including zero? Both maps preserve modulus and their phases cancel. The label multiplier is correctly c^2. It is not presented as an integer-preserving map. Supported.
Proposition 9.3	Is a sampled recursive image assigned an unjustified dimension? No. The singleton limit, countable scale family and separate IFS are distinguished. The classical dimension conclusion explicitly requires the open set condition. Supported.
Theorem 10.1	Does matching a type name prove correct composition? The theorem instead assumes local correctness, membership and preconditions. Its induction is valid, but does not itself prove the entire Python implementation correct. Supported with this boundary.
Theorem 10.2	Does the finite certificate allegedly prove every analytic statement? The paper explicitly notes that part (c) is analytic and independent of the finite moments. The theorem assembles compatible consequences with separate hypotheses. Supported as a synthesis.
Proposition B.1	Can reversed remainders admit an earlier zero or a different seed? Strict reverse increase excludes padding, Euclidean division fixes each predecessor, and the seed check binds the result. Supported.

The paper's contribution is an explicit mathematical integration and reproduction framework. Many component facts are elementary or classical; the manuscript generally acknowledges that. This review does not establish first discovery of the Hausdorff identity, the antisymmetric localization formula, or the energy calculation. A stronger originality claim would need a focused literature comparison beyond the present correctness audit.

4 Independent execution record

The reference certificate was regenerated under normal Python and `python -O`. Both executions produced the same certificate hash as the supplied one. The existing-bundle verifier accepted the actual submitted files. A separate audit compared every stored ledger with independently calculated forward quotient and remainder data, rather than trusting the stored histogram.

Check performed in this review	Outcome
Top-level input manifest	84 of 84 listed files matched
Nested companion input manifest	73 of 73 listed files matched
Regenerated normal and optimized certificate	Both matched the original certificate hash
Existing submitted bundle	32 blocks and 32,768 rows accepted
Independently recomputed transitions	300,871, with maximum first-zero depth 10
Independent floor-sum recurrence validation	29,700 small cases agreed with direct summation
Independent first-boundary sums	Both equal 302,541,195,258,184
Independent spherical monomials	56 of 56 matched exactly
Exact sixth-degree witness	Error $-1/105$
Symbolic localization checks	Dimensions 3, 4, 5 and 8; arbitrary symbolic nonradial cutoff
Released interface and bundle suite	18 tests passed normally and with optimization
Released numerical model suite	Nine tests passed
New numerical boundary suite	Three tests passed normally and with optimization
Forged-output mutations	662 rejected across all 18 registered operations
Saved path replay	All eight supplied examples passed
Model export	Three- and five-dimensional exports completed

Check performed in this review	Outcome
Supplied symbolic field generator	Three- and five-dimensional expressions returned zero divergence
Viewer logic	Seven scenes exercised; 1,160 strokes; no stub-detected errors
Appendix D printed algorithm	All 32,768 seeds reconstructed, with 300,871 transitions

The independent parameter enclosure uses 80 alternating-series terms and a square-root scale of 10^{100}, different from the released checker. Its floor-sum implementation uses a complementary-rectangle recurrence rather than calling the released recurrence. Both computations corroborate the proofs; neither replaces the analytic interpretation of the bounds.

The adversarial mutations altered output fields, types, values and nested data while keeping the operation's source and context fixed. Rejection was the expected behavior. All 662 were rejected. This is a finite test set, not an exhaustive proof over every possible malicious input, and it does not certify resistance to resource exhaustion. It does directly challenge the central claim that a valid-looking output cannot be substituted merely by retaining a matching type label.

The numerical and exact execution environment was Python 3.12.14, NumPy 2.3.5 and SymPy 1.14.0. The independent symbolic audit requires SymPy. The paper's standard-library exact checker does not.

5 Defects reproduced and corrected

5.1 Nonfinite derivative at a valid schedule input

In the submitted `omega_models.py`, this call produces nonfinite rates:

```
import omega_models as model
model.motion_schedule(1e-200)
# Original result: (1.0, 0.0, nan, nan)
```

The mathematical flat-step derivative is finite and positive at this input, with a value far below binary64's representable positive range. The code forms a reciprocal square after that square has underflowed to zero, then multiplies an infinite quantity by an exponential that has underflowed to zero. The result is `NaN` and two runtime warnings. This is an implementation defect, not a singularity of the proved smooth function.

The correction uses the representable limiting values in the extreme endpoint tails and evaluates the original expression only where the reciprocals remain safe. For $0 < s \leq 10^{-6}$ the step and derivative are far below the smallest binary64 subnormal; the opposite tail is handled symmetrically. Nonfinite arguments are also rejected explicitly. Tests include the smallest positive binary64 subnormal, 10^{-200}, 10^{-160}, ordinary interior values and points immediately below one.

The corrected call returns `(1.0, 0.0, 0.0, 0.0)` without a runtime warning. This is a numerical underflow convention, not an alteration of the exact smooth schedule theorem.

5.2 Finite matrix entries do not establish usable volume preservation

The submitted function accepts `flow_matrix(1.0, 20.0, 3)`. Its returned entries are finite. Nevertheless, the determinant calculated by NumPy in this environment is approximately -6.4663, rather than one. To distinguish determinant-evaluation error from matrix-entry error, I also calculated the exact determinant of the stored binary64 planar entries using rational arithmetic. It is

$$-\frac{578898534050705}{281474976710656} \approx -2.05666074056.$$

Thus even exact evaluation of the returned entries does not recover a determinant near one. The exact mathematical matrix remains positive definite and has determinant one. At $\eta = 20$, its planar eigenvalues differ by a factor e^{40}; binary64 cannot reliably retain the small eigenvalue in the expanded matrix representation.

The correction screens the exact-form eigenvalue condition number before constructing the matrix. Its logarithmic eigenvalues are

$$\log c + \eta, \quad \log c - \eta, \quad -\frac{2\log c}{m-2}.$$

The numerical routine rejects inputs when machine epsilon times the corresponding spectral condition number exceeds 10^{-8}. Computing the screen in logarithms also avoids overflow in the screening calculation. This threshold is an explicit numerical acceptance policy, not a rigorous error certificate or a restriction on Theorem 7.6. The revised manuscript and interface contract state that distinction.

The regression test rejects the demonstrated ill-conditioned case, its negative-anisotropy counterpart, and an extreme scale case. It also checks the exact determinant of a moderate returned binary64 matrix against a stated tolerance. Existing moderate-parameter paths continue to replay successfully.

5.3 Abstract scope and dependency instructions

The original abstract says that the construction realizes any prescribed finite motion of a compact set. Read independently of Section 7, that phrase can suggest motions outside the displayed deformation family. The revised sentence explicitly says "in the stated deformation family." The theorem statements and proofs have not changed.

The exact checker and exact interface operations use the standard library, but the integrated interface test suite and path exporter also exercise numerical adapters and therefore import NumPy. The revised reproduction paragraph says to install the pinned requirements before running the entire command list. It preserves the narrower standard-library claim for the exact-only operations. The pinned NumPy 2.3.5 requires Python 3.11 or later for the complete numerical suite; the exact-only Python 3.10+ claim is unaffected.

6 Publication boundaries and provenance

The exact registered geometry is conditional on a fixed template, retained positive resolution, placement and labels. It does not encode an arbitrary geometric object in a scalar. The ratio λ is a selected observation; it cannot determine a scale or frame. These limits are mathematically necessary and already explicit in the paper.

The real-floor agreement ends at the first disagreement seed $42,189,065$ as a contiguous prefix statement. It is not a claim that every later seed disagrees. The equality resumes at the next seed. The fiber theorem remains a theorem of the rational integer map globally; it must not silently be transferred to the real map beyond the certified domain.

The twelve-node rule is the classical icosahedral degree-five design. The claim is used with an elementary proof and exact replay, rather than as a new discovery. The author-maintained spherical-design archive was accessible during this review. Hutchinson's author-hosted paper supports the fixed-set and open-set-condition result cited in Proposition 9.3.

The cited proof by reflection text, Flyspeck preprint, nonlinear-inequality verification paper, and Cube20 project were accessible and consistent with their methodological roles. They do not certify this paper's code.

The tools used for this review could not retrieve the seven earlier OMEGA DOI targets, the cited extension route, or the newly supplied DOI target. This does not establish that those identifiers are invalid or unpublished. It means that the deposit metadata and exact retrospective attribution to those versions were not independently confirmed here. The manuscript's own Appendix C already discloses this boundary. Its current proofs are supplied in the manuscript and do not require trusting those remote pages.

The DOI was inserted as the identifier supplied by the author. Adding it to the files is not registration, activation or deposit of a Zenodo record. No external publication action was performed.

The 4096-cell Bernstein payload, higher-degree cubature searches, historical Lean sources and unrelated earlier papers were not recertified by this audit. The source package explicitly excludes them from its current acceptance claims. The browser viewer was checked through its supplied JavaScript logic harness; no claim of a full interactive browser visual audit is made.

7 Revised files and reproduction

The release retains the unchanged exact reference checker, all original exact ledger bytes, the certificate, the exact interface implementation, Appendix D's algorithm, and the saved numerical examples. The numerical module is version 0.1.1. Its envelope schema remains `OMEGA_INTERFACE/1.1`; no exact payload meaning changed.

Changes are limited to the DOI, the abstract scope phrase, numerical implementation and regression tests, corresponding reproduction and boundary documentation, regenerated manuscript editions, manifests and audit records. The older execution and production records are identified as historical. No stronger theorem, formal verification claim, or physical interpretation was added.

The exact certificate still has SHA-256

`32bcc2fefc44d0fe19575683b64fd67ddcd32327aeff32ab14cc988a507f4a79`

The exact reference checker still has SHA-256

`dbf0650cf80c9e618684d98292bf7592baadadc51bd2eccf15b950392dcd5c8b`

The `review` directory contains the independent audit program, original and revised JSON results, the execution logs, the original numerical module for reproducing the reported failures, this report's source, and the final report. The original JSON records the numerical failures; the revised JSON records the guarded rejections and finite schedule output. This preserves evidence of the defects rather than replacing it with a success-only history.

From the extracted release root, the independent review can be rerun as follows after installing the pinned requirements:

```
python -m pip install -r companion/requirements.txt
python review/independent_review.py .
cd companion
python verify_external_bundle.py sample_certificate
python test_interface.py
python -O test_interface.py
python test_omega_models.py
python test_numerical_boundaries.py
python -O test_numerical_boundaries.py
```

The mathematical verdict rests on the proofs under their stated assumptions, supported by the reproduced finite calculations. The revised release addresses the concrete failures found in this review and is ready for a preprint deposit under the supplied identifier.