

The Conlan/Maxwell Equations — Part Two

Oct 17, 2026 · @Paul Conlanwe Have Met Love We Are Old Friends I Think Possibly

Scope and architecture

Part Two preserves Maxwell’s 1865 twenty scalar equations unchanged and attaches the Conlan extensions to them equation by equation. Historical findings are recorded, never silently repaired.

Layer	Content	Status
A	Maxwell 1865, Groups A-H (20 equations), as printed	Preserved; sign audit recorded (A1-R3)
B	Conlan extensions attached per group	Complete for all twenty
B-S	Substrate dynamics addendum	Locked (B-S1 to B-S3)
C	Derived consequences	C-1 to C-3 assigned; C-4 draft
D	Numerical simulation and verification	Not begun

Governing principle. The record is governed by causal equivalence: one causal structure operating across different physical descriptions. Substrate equivalence (H-SE) is a separate, unproven hypothesis and is not an axiom of this record.

Causal sequence under test. The sequence is disturbance, interaction, circulation or oscillation, resonance, redistribution, and dynamic equilibrium. Each stage needs an operational definition that can fail:

- **Disturbance and interaction:** a departure from a stationary action.
- **Circulation:** a nonzero vorticity or gyroscopic term.
- **Resonance:** a normal mode of the linearized equations.
- **Redistribution:** a flux term in the conservation laws.
- **Equilibrium:** a stationary state with balanced fluxes.

Epistemic status. Every result below is a mathematical consequence of the stated model. None of it is experimental confirmation of a physical substrate.

Layer A: historical sign audit

As printed, Groups G and F and the §79 force formula follow a sign convention opposite to the rest of the 1865 system. Reversing G and F together restores consistency with every other part of the paper (finding A1-R3). All findings rest on an OCR transcription and await verification against page scans.

A1a: continuity (Groups A, C, G, H)

Taking the divergence of printed Group A, then combining it with G and H, gives:

$$\nabla \cdot \mathbf{J}_{\text{tot}} = -2\epsilon_0 \frac{\partial \rho}{\partial t}$$

This means the printed equations forbid any time-varying charge. The error is exactly one sign. Flipping A, G or H alone removes it.

A1b: constitutive (Groups A, E, F)

Write the mappings as $p = aJ$, $f = bD$ and $P = dE$. Then:

- Group E gives $d = b$.
- Group F gives $d = -a$.
- So E and F together require $a = -b$.
- Groups A and C require $a = b$.

The two requirements contradict each other.

Candidates eliminated

- **Coordinate handedness.** Groups A, E and F contain no curls, so orientation cannot affect them.
- **Reversing Group A.** Group A drives the wave derivation (§§93–95) and §106. Reversing it destroys propagation and the light-speed result $V = \sqrt{k/4\pi\mu}$.
- **H1-a (e means different things in G and H).** §86 uses a single e in both.

A1-R3: governing finding

Groups G and F and the §79 formula use the convention $e \rightarrow -e$, $p \rightarrow -p$. Within themselves they are coherent. They conflict, however, with:

- Maxwell's definition of "free positive electricity" (§68).

- His §79 prose, where the force acts along the EMF.
- Group A, which adds p to the rate of change of f .
- §§94–95 and §106.

Reversing G and F together passes every test, including the wave and absorption results. A1a and A1b are two symptoms of one convention seam, which is located in Part II.

Evidence	Location	Bears on
$kf = +d\Psi/dx$, departing from Group D	§83 eq. 48	Reverse G (R2a)
$\Psi = +(k/4\pi)e/r$; a single charge would have negative energy under printed G	§79	Reverse G (R2a)
$X = -Pe$, contrary to the accompanying prose	§79	Reverse G (R2a)
$A_1 = +e_1$, silently uses the reversed G	§87, §88 eq. 57	Operational reversal
$\xi = \oint P \cdot ds$ with $\xi = Rx + \dots$ and positive heat Rx^2 give $P = +\epsilon p$	§§32, 63	Reverse F (R2b), decisive
Absorption result and §88 under consistent G	§106, §88	Reverse F (R2b), supporting

Hypothesis (testable, not established). §79 claims to follow "the same demonstration" as the magnet case in §77. There the potential gradient enters with a positive sign while the EMF is the negative gradient. Carrying that over without flipping it would produce exactly these anomalies. The hypothesis can be checked against the 1861 and 1873 texts.

Attribution. Whether the error is Maxwell's or the printer's is not asserted. The record is coherent in pieces, and the inconsistency sits at the seam between the two conventions.

Pending: scan verification of pp. 480–490 (§§55, 68–69, 79, 83, 86–88). On p. 485, the resistance symbol is recorded as p in V3 and ϵ in the OCR.

Layer B: extensions to the twenty equations

Only Group A is extended. The vortex current enters there and nowhere else, and the other seven groups take no extension.

The core objects are:

$$\begin{aligned} \mathbf{M}_v &= \gamma_v \mathbf{v}, \quad \mathbf{J}_v = \\ &\nabla \times \mathbf{M}_v, \quad \mathcal{L}_{\text{int}} = \\ &\gamma_v \mathbf{v} \cdot \mathbf{B} \end{aligned}$$

Here γ_v is a phenomenological coefficient with units of C/m². It is named to avoid a clash with Maxwell's magnetic component γ .

Group	Eqs	Maxwell's title	Layer B disposition
A	1–3	Total currents	$\mathbf{J}_{\text{tot}} = \mathbf{J}_{\text{cond}} + \partial_t \mathbf{D} + \nabla \times (\gamma_v \mathbf{v})$. For uniform γ_v , $\mathbf{J}_v = \gamma_v \boldsymbol{\omega}$ with $\boldsymbol{\omega} = \nabla \times \mathbf{v}$.
B	4–6	Magnetic force	No extension. $\mathbf{B} = \nabla \times \mathbf{A}$ guarantees $\nabla \cdot \mathbf{B} = 0$.
C	7–9	Electric currents	$\nabla \times \mathbf{H} = \mathbf{J}_{\text{tot}}$. The vortex current enters only through A. Constitutive rule: $\mathbf{B} = \mu_o (\mathbf{H} + \mathbf{M})$, where $\mathbf{M}$ excludes $\mathbf{M}_v$.
D	10–12	Electromotive force	No extension. Baseline $P = \mu(\gamma \, dy/dt - \beta \, dz/dt) - dF/dt - d\Psi/dx$. Substrate EMF is derived in B-S2.
E	13–15	Electric elasticity	No extension. $P = k f$, where k is not $1/\epsilon$ in SI without unit conversion. $P_v = 0$ is a scope choice, not a prohibition.
F	16–18	Electric resistance	No extension. $\mathbf{J}_v$ is excluded from Ohm's law (bound current, no Joule heat). The printed minus sign is flagged under A1-R3 (R2b).
G	19	Free electricity	No extension. $\nabla \cdot (\nabla \times \mathbf{M}_v) \equiv 0$, so the substrate carries no charge. This is an identity, not physical evidence. Flagged under A1-R3 (R2a).
H	20	Continuity	No extension. Scope note on §69's conditional introduction.

Bookkeeping rule. The vortex contribution enters through $\mathbf{J}_v$ in Group A or through $\mathbf{M}$ in the constitutive relation, never both. Counting it twice would double count it in $\nabla \times \mathbf{H}$. That is bookkeeping, not physics. Real compounding would need its own term and coefficient (Item K).

Addendum B-S: substrate dynamics

In the B-S model the substrate is a massive compressible fluid. One action yields both the Group A vortex current and the reciprocal force on the fluid, and it conserves energy, linear momentum and angular momentum without any added spin.

B-S1: model and action

Three model choices define the substrate:

- A massive compressible fluid with density ρ_s and internal energy per unit mass $U(\rho_s)$.
- A coupling attached to the material elements: $\gamma_v = \kappa n_s$, with κ constant (units C·m).
- A velocity equal to the material-flow velocity, $v = dx/dt$.

The constraints are enforced in Lagrangian (material) coordinates. The action is:

$$S = \int \Big[\frac{1}{2} \epsilon_0 E^2 - \frac{B^2}{2\mu_0} - \rho_q \phi + \mathbf{J}_{\text{cond}} \cdot \mathbf{A} + \frac{1}{2} \rho_s |\mathbf{v}|^2 - \rho_s U(\rho_s) + \gamma_v \cdot (\nabla \times \mathbf{A}) \Big] d^3x dt$$

Varying A reproduces the Group A route:

$$\nabla \times \mathbf{H} = \mathbf{J}_{\text{cond}} + \partial_t \mathbf{D} + \mathbf{J}_v$$

Varying the fluid trajectories gives the reciprocal force:

$$\rho_s \frac{D\mathbf{v}}{Dt} = -\nabla p_s + \gamma_v \big[-\partial_t \mathbf{B} + \mathbf{v} \times (\nabla \times \mathbf{B}) \big]$$

The canonical momentum density is $\rho_s v + \gamma_v B$. The continuum limit closes because $\gamma_v = \kappa n_s$ carries no further dependence on density.

The motional polarization $P = v \times M_v / c^2$ vanishes identically because M_v is parallel to v . No ad hoc $-P \cdot E$ term is needed. This holds at first order in v/c and does not establish Lorentz covariance.

B-S2: EMF without double counting

No new EMF coefficient is introduced. The substrate's own field and its EMF follow from $\mathbf{J}_v$:

$$\mathbf{B}_v = \mu_0 \gamma_v \mathbf{v}_T, \quad \oint \mathbf{E} \cdot d\mathbf{l} = -\mu_0 \gamma_v \frac{d}{dt} \int \mathbf{v}_T \cdot d\mathbf{S}$$

The central identity is:

$$\mathbf{J}_v \cdot \mathbf{E} = \mathbf{f} \cdot \mathbf{v} + \nabla \cdot (\mathbf{M}_v \times \mathbf{E})$$

Field work done through $\mathbf{J}_v$ equals the mechanical power the fluid receives, up to a flux term. A separate Group D EMF term would therefore be a second channel for the same transfer.

B-S3: conservation closure

Energy. The only sink is conduction work, and the energy flux is $\mathbf{E} \times \mathbf{H}_{\text{eff}}$:

$$\partial_t(u_{\text{EM}} + u_{\text{fl}}) + \nabla \cdot [\mathbf{E} \times (\mathbf{B}/\mu_0 - \mathbf{M}_v) + \mathbf{S}_{\text{fl}}] = -\mathbf{E} \cdot \mathbf{J}_{\text{cond}}$$

Linear momentum. Momentum closes because of the material-attached coupling, which gives:

$$\partial_t \gamma_v + \nabla \cdot \mathbf{M}_v = 0$$

This removes the only term that would otherwise break conservation. It is an independent check on the choice of coupling.

Angular momentum. Angular momentum closes with $\mathbf{K} = 0$ and no intrinsic spin. The interaction stress is symmetric:

$$\begin{aligned} P^{\text{int}}_{ij} &= M_{v,i} B_j + B_i M_{v,j} - \\ &(\mathbf{M}_v \cdot \mathbf{B}) \delta_{ij}, \quad \mathbf{g} = \\ &\rho_s \mathbf{v} + \gamma_v \mathbf{B} + \\ &\epsilon_0 \mathbf{E} \times \mathbf{B} \end{aligned}$$

This was checked independently at the level of a single particle. The torque $\mathbf{v} \times \mathbf{B} + \mathbf{x} \times \nabla(\mathbf{v} \cdot \mathbf{B})$ is cancelled exactly by the field's $-\int \mathbf{x} \times (\mathbf{J}_v \times \mathbf{B})$.

Correction record. An earlier asymmetric stress, $\mathbf{M}_v \otimes \mathbf{B}$, dropped the $\mathbf{B} \otimes \mathbf{M}_v$ term. That term is a pure divergence because $\nabla \cdot \mathbf{B} = 0$. The asymmetric form, and the Test-B verdict built on it, are withdrawn.

Consequence for CDVEF. In the minimal model the "vortex" is orbital vorticity $\omega = \nabla \times v$, not spinning substrate elements. Intrinsic spin is an optional extension that would need its own justification.

Layer C: derived consequences

Four consequences follow from B-S, and none has been developed or tested yet. C-1 is the model's only prediction that departs from standard physics. It is therefore the result that publication of Layer B depends on.

Item	Consequence	Status
C-1	Effective transverse inertia $\rho_s + \mu_0 \gamma_v v^2$, from self-coupling. The Bernoulli term is not renormalized.	Assigned; untested prediction
C-2	Zero interaction energy density. L_{int} is linear in v , so it contributes nothing to the Hamiltonian.	Assigned
C-3	Conserved substrate momentum $\rho_s v + \gamma_v B$. It is carried even where $v = 0$ locally, provided $\gamma_v \neq 0$.	Assigned
C-4	Modified wave equations, valid only in the prescribed-flow limit (below).	Draft

The C-4 draft equations are:

$$\nabla^2 \mathbf{E} - \mu_0 \epsilon \partial_t^2 \mathbf{E} - \mu_0 \sigma \partial_t \mathbf{E} = \mu_0 \partial_t \mathbf{J}_v$$

$$\nabla^2 \mathbf{B} - \mu_0 \epsilon \partial_t^2 \mathbf{B} - \mu_0 \sigma \partial_t \mathbf{B} = -\mu_0 \nabla \times \mathbf{J}_v$$

C-4 holds only when the flow is prescribed. Because v is dynamical, part of the source term is self-coupling, and that part belongs to C-1.

Shared invariant. Every coupling that is linear in velocity produces three things: a shifted canonical momentum, a gyroscopic force that does no work, and zero stored interaction energy. Examples are $q v \cdot A$, $m v \cdot (\Omega \times x)$ and $\gamma_v v \cdot B$. This property can be checked, and it fails for couplings that are not linear in velocity.

Unresolved findings and open items

The scan verification blocks publication of Layer A. A tested C-1 prediction blocks publication of Layer B.

- ☐ Verify pp. 480–490 of the 1865 paper against facsimile scans (§§55, 68–69, 79, 83, 86–88).
- ☐ Settle the resistance symbol on p. 485: ρ (V3) or ε (OCR).
- ☐ Check the §77 carry-over hypothesis against the 1861 and 1873 texts.
- ☐ Check prior historical literature on the 1865 sign conventions.
- ☐ Determine a constitutive law for γ_v (currently phenomenological).
- ☐ Item K, geometric energy compounding: define a term, a coefficient and a place in the action. The experimental basis is held by Paul and has not been shown.
- ☐ Define R (resonance-energy density) and C (coherence), with units and a place in the action, before either enters the ledger.
- ☐ Optional extensions, each needing its own coefficient and justification: intrinsic spin, substrate polarization P_v , and a direct Ψ/E coupling for a distinct substrate EMF.
- ☐ H-SE (substrate equivalence) and a future unification addendum B-U.
- ☐ Develop Layer C, starting with C-1.
- ☐ Layer D: numerical simulation and verification.
- ☐ Decide how AI assistance is credited. Recommendation: state plainly that AI tools were used, so the line between the author's ideas and AI help stays clear.