Nexus — Complete Foundational Equation (recycling excluded)

Below is the complete Nexus equation beginning from the foundational layer — a single, self-contained mathematical model of the system's state, issuance/destruction mechanics, feedback controllers, and constraints. I exclude the recycling/point-of-sale thread and any domain-specific recycling mechanics; this is the core, general-purpose Nexus economy + OS model you can reuse across domains.

I present:

1. variables & interpretation,

2. continuous-time core differential system,

3. issuance / burn functional forms,

4. feedback (regulation) term,

5. long-run conservation constraint,

6. discrete-time implementation (for simulation / smart contracts), and

7. compact operator form + short parameter notes.

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1 — Variables and definitions

All functions depend on time .

— Nexus aggregate systemic state (total systemic value / intelligence).

— validated human contribution rate (value units / time).

— machine/automated contribution rate.

— environmental / energy / ecological index (normalized,).

— quality-weighted data inflow rate (signals / time).

— Floor (baseline guaranteed value; can be constant or time-varying).

— issuance rate (value created per unit time).

— burn/destruction rate (value destroyed per unit time).

— net credit flow.

— temporal decay coefficient (units 1/time); optionally for half-life .

— feedback/regulation (controller) term (can be PID-like).

— System Health index (normalized,).

— adaptive issuance and burn gains (controller levers).

— nonnegative weights for input importance.

— target Nexus state (policy anchor).

— coupling coefficient that injects the Floor into dynamics.

All scalar quantities are normalized/units-consistent.

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2 — Core continuous-time evolution (main differential equation)

$$\boxed{\displaystyle
\frac{dN}{dt} \;=\; I(t) \;-\; B(t) \;-\; \kappa\,N(t) \;+\; \Phi(t) \;+\; \eta\,F(t)
}$$

Interpretation:

Issuance increases systemic value; burn decreases it.

captures natural temporal decay (value/time).

is the regulator that corrects deviations from the target.

ensures the floor provides a persistent baseline injection.

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3 — Issuance and burn functional forms

3.1 Issuance (validated contributions → issuance)

$$\boxed{\displaystyle
I(t) \;=\; \alpha(t)\; S(t)\;\big(w_H H(t) + w_M M(t) + w_D D(t) + w_E E(t)\big)
}$$

down-weights issuance when system health is poor.

is an adaptive gain (controller output) that increases or reduces issuance in response to systemic conditions.

3.2 Burn (consumption / disposal / ecological load)

$$\boxed{\displaystyle
B(t) \;=\; \beta(t)\;\big(\gamma_C C_{cons}(t) + \gamma_D C_{disp}(t) + \gamma_E \,\ell(E(t)) \big)
}$$

: measured consumption/extraction rate (units aligned to issuance).

: measured disposal/waste rate.

: ecological load function (higher when environment stressed).

: adaptive burn gain.

Notes: 's are tunable sensitivity constants. Choose forms so and are commensurate.

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4 — Feedback / regulation (stabilizer)

Define error:

$$e(t) \;=\; N(t) - N^*(t)$$

A general PID-like regulator:

$$\boxed{\displaystyle
\Phi(t) \;=\; -K_p\,e(t) - K_i\!\int_0^t e(s)\,ds \;-\; K_d\,\frac{d e}{dt}
}$$

tune responsiveness, integral action enforces long-run conservation, derivative damps rapid changes.

may be bounded to avoid actuator saturation: .

Alternative: can be implemented as model-predictive control (MPC) for better performance under constraints.

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5 — System Health index

One normalized example:

$$\boxed{\displaystyle
S(t) \;=\; \sigma\!\Big(\lambda_E E(t) + \lambda_N\frac{N(t)}{N_0} +
\lambda_H\frac{H(t)}{H_0} + \lambda_M\frac{M(t)}{M_0} \Big)
}$$

are normalization constants.

's are weights.

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6 — Conservation / long-run 1:1 constraint

Nexus design enforces that long-run average issuance equals long-run average burn (no uncontrolled inflation):

$$\boxed{\displaystyle
\lim_{T\to\infty}\frac{1}{T}\int_0^T\! I(t)\,dt
\;=\;
\lim_{T\to\infty}\frac{1}{T}\int_0^T\! B(t)\,dt
}$$

Equivalently, at steady state (neglecting small decay & floor injections),

$$\overline{I}\;\approx\;\overline{B}$$

$$\boxed{\displaystyle
\int_0^T (I(t)-B(t))\,dt \;=\; N(T)-N(0) + \int_0^T \big(\kappa N(t)-\Phi(t)-\eta F(t)\big)\,dt
}$$

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7 — Compact operator / control form

Write the dynamics as an operator :

$$
\boxed{\displaystyle
\frac{dN}{dt} \;=\; \mathcal{G}\big(N,H,M,E,D; \alpha,\beta,\kappa,F,N^*,K_p,K_i,K_d\big)
}
$$

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8 — Discrete-time implementation (for simulation / deployment)

Let timestep and index . Variables at step : .

Update rules:

$$
\begin{aligned}
I_k &= \alpha_k\; S_k\; (w_H H_k + w_M M_k + w_D D_k + w_E E_k) \\
B_k &= \beta_k\; (\gamma_C C_{cons,k} + \gamma_D C_{disp,k} + \gamma_E \ell(E_k)) \\
e_k &= N_k - N^*_k \\
\Phi_k &= -K_p e_k - K_i \sum_{j=0}^k e_j \Delta t - K_d \frac{e_k-e_{k-1}}{\Delta t} \\
N_{k+1} &= N_k + (I_k - B_k - \kappa N_k + \Phi_k + \eta F_k)\,\Delta t
\end{aligned}
$$

Adapt with simple rules (e.g., gradient descent on error, or controller outputs limited to bounds).

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9 — Parameter notes and implementation guidance

Decay / half-life: set for desired half-life of issued value.

Weights : select to reflect policy priorities (e.g., large if human validation preferred).

Saturation & clamps: clamp to avoid runaway issuance/burn.

Normalization: scale so magnitudes produce sensible .

Oracles & inputs: must come from robust oracles/validators with anti-Sybil measures.

PID tuning: start with conservative ; prefer integral action for long-run conservation.

Safety: implement emergency clamps that set or freeze issuance if input integrity fails.

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10 — Minimal checklist to preserve the foundational equation in any extension

1. Every issuance event must have an observable provenance (who/what validated it).

2. Every burn event must be tied to a verifiable destruction/consumption proof.

3. The controller must be able to reduce issuance when systemic overshoot is detected.

4. Oracles feeding must be auditable and have slashing/penalty mechanisms for fraud.

5. Maintain accounting separation between the token accounting layer (issuance/burn) and cash/treasury layer (reserves, receivables).

Final compact boxed equation (foundational)

$$
\boxed{\displaystyle
\frac{dN}{dt} \;=\; \alpha(t)S(t)\big(w_H H+w_M M+w_D D+w_E E\big)
\;-\;\beta(t)\big(\gamma_C C_{cons}+\gamma_D C_{disp}+\gamma_E\ell(E)\big)
\;-\;\kappa N(t)\;+\;\Phi(t)\;+\;\eta F(t)
}
$$
