Non-linear Solve Methods (A Generalization)

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1 Introduction

This is a brief explanation of the general method whereby which one can solve for

$$\Omega_{\Lambda'}(x,z) \;=\; \left(f(x,z) + \sum_{i=1}^{n} \Big(\delta(x_i,z_i) + \varphi_{\Lambda'}(x_i,z_i) \Big) \right).$$

Where δ is the data constraint function, $\varphi_{\Lambda'}$ is the model complexity regularization term, and f is the objective function to be optimized. The objective function is defined as:

f(x,z) $= \Omega_\Lambda \Big(\sum_{h \to \infty} \frac{B \heartsuit i \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \cdot \star \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{i}} + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{i \oplus \sim \cdot \heartsuit} \right| \Big).$

Then,

Let $f(x,z)$ be a function of two variables x and z. The generalised methods for solving such functions can be summarised as follows:

1. Calculate the derivative of $f(x,z)$ with respect to x and z.
2. Set the derivative of $f(x,z)$ with respect to x and z to zero. This yields two equations.
3. Solve the two equations obtained in step 2 for the two variables x and z.
4. Check for any constraints on the obtained values of x and z and substitute the suitable values in the original equation and calculate the value of the function.

Let x and z be a pair of real-valued variables and let $\mathcal{F}$ be a function representing system that depends on them. The equation is given as a general formula,

F(x,z) $= \gamma \oplus \alpha(x,z) \cdot \Omega_\Lambda(\mathcal{D})$.

Now let θ be a vector of real-valued parameters which can be estimated to fit the data. The objective is to find the best model parameters that minimize the error between the model and the data. To solve this problem, we can use optimization algorithms, such as gradient descent, to search for an optimal set of parameters θ. The optimization can be expressed in a mathematical form as

$\hat{\theta} = argmin_{\theta}\left\{\mathcal{L}(\theta) = \int_x \int_z \left(\mathcal{F}(x,z) - \gamma \oplus \alpha(x,z,\theta) \cdot \Omega_\Lambda(\mathcal{D})\right)^2 \mathrm{d}x\, \mathrm{d}z\right\}$, where $\hat{\theta}$ is the optimal parameter vector that minimizes the error between the model and the data. This procedure can be generalized to other systems and systems of equations.

Generalize the non-linear solve methods above and notate procedures mathematically for application to other systems:

Let $\mathcal{D}$ be a set of data and $\mathcal{F}_\Lambda$ be a nonlinear function of the parameter vector Λ. Define the objective function $\mathcal{F}_\Lambda$ as:

$$\mathrm{F}_\Lambda(\mathcal{D}) = \gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A} \cdot \prod_\Lambda}{\sim \mathcal{H} \star \oplus \quad star\ \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}}$$
$$+ \quad \min\left\{z_1, \ldots, z_n\right\} \cdot \max\left\{x_1, \ldots, x_n\right\} \prod_{i=1}^n p(z_i, x_i)$$

where $\mathcal{H}, \mathring{A}, \Delta$ and Λ are set of parameters. The non-linear solve process can then be mathematically notated as:

$$_\Lambda[\mathcal{F}_\Lambda(\mathcal{D})]$$
$$=_\Lambda \left[\gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A} \cdot \prod_\Lambda}{\sim \mathcal{H} \star \oplus\ \star\ \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} + \min\left\{z_1, \ldots, z_n\right\} \cdot \max\left\{x_1, \ldots, x_n\right\} \prod_{i=1}^n p(z_i, x_i)\right] \cdot$$
$$\mathcal{D}$$

Then, for each parameter Λ_i, it is necessary to find its optimal value $\hat{\Lambda_i}$ by determining the maximization of the objective function using the set of parameters, so that $\mathcal{F}_\Lambda(\mathcal{D})$ is maximized. This is equivalently given by,

$\hat{\Lambda_i} =_\Lambda [\mathcal{F}_\Lambda(\mathcal{D})] \cdot \mathcal{D}$

Finally, the optimal set of parameter values can be obtained by solving the equation in terms of the parameter vector as follows:

$\hat{\Lambda} =_\Lambda [\mathcal{F}_\Lambda(\mathcal{D})] \cdot \mathcal{D}$.

The non-linear solve methods discussed above can be applied to many other systems, with the methodology being similar regardless of the specific system.

Consider now that the data and the nonlinear function $\mathcal{F}_\Lambda$ have been given, the solution process may be summarized as $\hat{\Lambda} =_\Lambda [\mathcal{F}_\Lambda(\mathcal{D})]$, $F_\Lambda = \alpha(x,z) \times \Gamma(\sigma, \Phi) \times \Omega_\Lambda(\cdot)$. Where $\hat{\Lambda}$ is the set of optimal parameters and Ω_Λ is the non-linear solve method used to maximize the objective function with respect to the parameter vector Λ.

The above expression illustrates the general formulation of a non-linear solve approach for other systems. The concept can be applied to various real world problems with slight modifications to the mathematical equations for the particular problem. As an example, consider a system subject to a constraint in order to eliminate certain values of the variables, the nonlinear solve method can be modified accordingly.

$\hat{\Lambda} \ = \ _\Lambda \mathcal{F}_\Lambda(x,z,\mathcal{D})\ subjectto\ \mathcal{G}(x,z,\mathcal{D}) \leq 0.$

The methods discussed in this article provide a generalizable solution to solve for the optimal parameters of a nonlinear function, which can then be applied to a variety of real world problems.

- For the first part, we can rewrite it as

$$\mathcal{E}_K = -(1-\tilde{\star}\mathcal{R})\times \frac{b^{\mu-\zeta}}{\tan^2 t \cdot \sqrt[m]{\prod_\Lambda h - \Psi}} \left(\Omega_\Lambda \diamond \sum_{[n]\star[l]\to\infty} \frac{b^{\mu-\zeta}}{n^m - l^m} + \Psi \star \sum_{h\to\infty} \frac{h^{-\frac{1}{m}}}{\tan t} \right).$$

- For the second part, we can rewrite it as

$$\mathcal{F}_\Lambda = \Omega_\Lambda \left(\gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \ \cdot \ \star \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} \ + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{\mathrm{i}\oplus \sim \cdot \heartsuit} \right| \right) \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A}$$

Let $\mathcal{D}$ be a set of data and $\mathcal{F}_\Lambda$ be a nonlinear function of the parameter vector Λ. Define the objective function $\mathcal{F}_\Lambda$ as:

$$\begin{aligned}\mathcal{F}_\Lambda \quad = \quad & \Omega_\Lambda \left(\gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \ \cdot \ \star \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} \ + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{\mathrm{i}\oplus \sim \cdot \heartsuit} \right| \right) \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A} \\ & + \mathcal{E}_K \cdot \left[\mathcal{R} + (1-\tilde{\star}\mathcal{R}) \times \frac{b^{\mu-\zeta}}{\tan^2 t \cdot \sqrt[m]{\prod_\Lambda h - \Psi}} \right] \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A}\end{aligned}$$

Where $\mathcal{H}, \mathring{A}, \Delta$ and Λ are set of parameters. The non-linear solve process can then be mathematically notated as:

$_\Lambda[\mathcal{F}_\Lambda(\mathcal{D})]$

$$=_\Lambda \left[\Omega_\Lambda \left(\gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \ \cdot \ \star \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} \ + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{\mathrm{i}\oplus \sim \cdot \heartsuit} \right| \right) \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A} \right.$$
$$\left. + \ \mathcal{E}_K \cdot \left[\mathcal{R} + (1-\tilde{\star}\mathcal{R}) \times \frac{b^{\mu-\zeta}}{\tan^2 t \cdot \sqrt[m]{\prod_\Lambda h - \Psi}} \right] \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A} \right] \cdot \mathcal{D}$$

Then, for each parameter Λ_i, it is necessary to find its optimal value $\hat{\Lambda_i}$ by determining the maximization of the objective function using the set of parameters, so that $\mathcal{F}_\Lambda(\mathcal{D})$ is maximized. This is equivalently given by,

$\hat{\Lambda_i} =_\Lambda [\mathcal{F}_\Lambda(\mathcal{D})] \cdot \mathcal{D}$

Finally, the optimal set of parameter values can be obtained by solving the equation in terms of the parameter vector as follows:

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The non-linear solve methods discussed above can be applied to many other systems, with the methodology being similar regardless of the specific system. Consider now that the data and the nonlinear function $\mathcal{F}_\Lambda$ have been given, the solution process may be summarized as $\hat{\Lambda} =_\Lambda [\mathcal{F}_\Lambda(\mathcal{D})]$,

$$F_\Lambda = \Omega_\Lambda \left(\gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \ \cdot \ \star \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} \ + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{\mathrm{i}\oplus \sim \cdot \heartsuit} \right| \right) \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A}$$
$$+ \ \mathcal{E}_K \cdot \left[\mathcal{R} + (1-\tilde{\star}\mathcal{R}) \times \frac{b^{\mu-\zeta}}{\tan^2 t \cdot \sqrt[m]{\prod_\Lambda h - \Psi}} \right] \cdot \oplus \cdot \mathrm{i} \Delta \mathring{A} \cdot \mathcal{D}$$

The non-linear solve methods discussed above can be applied to many other systems, with the methodology being similar regardless of the specific system.

This provides a generalizable solution to solve for the optimal parameters of a nonlinear function, which can then be applied to a variety of real world problems with slight modifications to the mathematical equations for the particular problem. As an example, consider a system subject to a constraint in order to eliminate certain values of the variables, the nonlinear solve method can be modified accordingly.

$\hat{\Lambda} \;=\; {}_{\Lambda}\mathcal{F}_{\Lambda}(\mathcal{D})\ subjectto\ \mathcal{G}(\mathcal{D}) \leq 0.$

$\mathrm{E} = \Omega_{\Lambda'} \left(b^{\mu-\zeta} \sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{1}{\sqrt[m]{n^m - l^m}} \otimes \prod_{\Lambda} h \right) \right.$
$\left. + \cos\psi \diamond \theta \; + \min \left\{ \Omega_{\Lambda'}\,(\mathrm{b} \to \mathrm{c})\,, \Omega_{\Lambda'}\,(\mathrm{d} \to \mathrm{e}) \right\} \prod_{i=1}^{n} \frac{p(x_i,z_i)}{\Omega_{\Lambda'}(\mathrm{e})} \oplus \cdot\, \mathrm{i}\Delta\mathring{A} \right).$

The quasi-quanta solution looks like this:

$\mathrm{E}_{\Lambda} = \left\{ \Omega_{\Lambda} \cdot \left[\sum_{i=1}^{\infty} \left(\Omega_{[i]} \cdot \mathcal{N}_{AB}^{[\cdots\to]} \star \sum_{[j]\leftarrow\infty} \left(\Omega_{[j]} \cdot \frac{1}{n - l\tilde{\star}\mathcal{R}} \right) \right) \right] \cdot \left\{ \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \right. \right.$
$\left. \left. \ldots \right\} \right\}.$

Now that the quasi-quanta solution is obtained, the nonlinear solve approach can be used to find the optimal parameter values for the system. The objective function $\mathcal{F}_{\Lambda}$ can then be written as:

$\mathrm{F}_{\Lambda} = \Omega_{\Lambda} \cdot \left[\sum_{i=1}^{\infty} \left(\Omega_{[i]} \cdot \mathcal{N}_{AB}^{[\cdots\to]} \star \sum_{[j]\leftarrow\infty} \left(\Omega_{[j]} \cdot \frac{1}{n - l\tilde{\star}\mathcal{R}} \right) \right) \right] \cdot \mathcal{D}$
$+ \left\{ \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \;\ldots \right\} \cdot \mathcal{D}\,,$

where $\mathcal{D}$ is the given data. The non-linear solve process can then be mathematically notated as:

$\hat{\Lambda} =_{\Lambda} [\mathcal{F}_{\Lambda}(\mathcal{D})]$

Where $\hat{\Lambda}$ is the set of optimal parameters. Then, for each parameter Λ_i, it is necessary to find its optimal value $\hat{\Lambda_i}$ by determining the maximization of the objective function using the set of parameters, so that $\mathcal{F}_{\Lambda}(\mathcal{D})$ is maximized. This is equivalently given by,

$\hat{\Lambda_i} =_{\Lambda} [\mathcal{F}_{\Lambda}(\mathcal{D})] \cdot \mathcal{D}$

Finally, the optimal set of parameter values can be obtained by solving the equation in terms of the parameter vector as follows:

$\hat{\Lambda} =_{\Lambda} [\mathcal{F}_{\Lambda}(\mathcal{D})] \cdot \mathcal{D}.$

The non-linear solve methods discussed above can be applied to many other systems, with the methodology being similar regardless of the specific system. This provides a generalizable solution to solve for the optimal parameters of a nonlinear function, which can then be applied to a variety of real world problems with slight modifications to the mathematical equations for the particular problem. As an example, consider a system subject to a constraint in order to eliminate certain values of the variables, the nonlinear solve method can be modified accordingly.

$\hat{\Lambda} \;=\; {}_{\Lambda}\mathcal{F}_{\Lambda}(\mathcal{D})\ subjectto\ \mathcal{G}(\mathcal{D}) \leq 0.$

The integration across the Primal Form of Topological Counting gives us the Ω_{Λ}:

$\Omega_{\Lambda} = \int_{\Omega_{\Lambda}} \mathcal{E}_{\Lambda}\, dx\, dy\, dz \ldots dt$

$= \int \Bigg\{ \Omega_\Lambda \cdot \Bigg[\sum_{i=1}^{\infty} \Big(\Omega_{[i]} \cdot \mathcal{N}_{AB}^{[\cdots\rightarrow]} \star \sum_{[j]\leftarrow\infty} \Big(\Omega_{[j]} \cdot \frac{1}{n-l\bar{\star}\mathcal{R}} \Big) \Big) \Bigg] \cdot \Bigg\{ \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F}$
$\ldots \Bigg\} \Bigg\} \, dx\, dy\, dz \ldots dt$

Finally, the final expression of the Ω_Λ is :

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$\Omega_\Lambda = \int_{\Omega_\Lambda} \mathcal{E}_\Lambda \, dx\, dy\, dz \ldots dt = \Bigg\{ \Omega_\Lambda \cdot \Bigg[\sum_{i=1}^{\infty} \Big(\Omega_{[i]} \cdot \mathcal{N}_{AB}^{[\cdots\rightarrow]} \star \sum_{[j]\leftarrow\infty} \Big(\Omega_{[j]} \cdot \frac{1}{n-l\bar{\star}\mathcal{R}} \Big) \Big) \Bigg] \Bigg\} \int \Bigg\{ \cos\psi \diamond$
$\theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots \Bigg\} \, dx\, dy\, dz \ldots dt\,.$

$\mathrm{E} \ = \int \mathcal{N}_{AB}^{[\cdots\rightarrow]} \Omega_\Lambda \left\langle \mathbf{x_1} \cdot \frac{\Delta \mathrm{A}}{\mathcal{H}+\mathrm{i}}, \frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right\rangle \mathrm{d}\cdots \mathrm{d}x_k$
$= \int \prod_{\Lambda'} \Big\{ \bullet \Big(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \Big) \diamond \Big(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \Big) \star \Big(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \Big) \heartsuit \Big(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \Big) \Big\} \mathrm{d}\cdots \mathrm{d}x_k$

$\mathrm{E} = \Omega_\Lambda \ \star \ \int \star \Big\{ \star \Big[\frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit\mathcal{H}\oplus\cdot} \Big] \Big\} \ \star d\mathbf{x_1} \ \star d\mathbf{x_2}.$

The result of this integration will yield a result in terms of the quasi quanta which can then be simplified further. In this way, we can reduce the complexity of integrations on nonlinear operators and express the result purely in terms of the form of quasi quanta, allowing us to analyze the integrations much easier.

$\mathrm{E} = \Omega_\Lambda \Big[\star \big(\frac{\Delta\mathcal{H}}{A\mathrm{i}} \big) \diamond \Big(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \Big) \star \Big(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \Big) \heartsuit \Big(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \Big) \Big] \ \mathrm{d}\cdots \mathrm{d}x_k\,.$

The functionally extended expression of the Quasi-Quanta Integrable Operational Integral (quasi quanta brackets ordering expression) can be written as:

$\mathrm{E} = \int_{\Omega_\Lambda} \mathcal{N}_{AB}^{[\cdots\rightarrow]} \Omega_{\Lambda'} \left\langle \mathbf{x_1} \cdot \frac{\Delta \mathrm{A}}{\mathcal{H}+\mathrm{i}}, \frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit\mathcal{H}\oplus\cdot} \right\rangle \mathrm{d}\cdots \mathrm{d}x_k \, \mathrm{d}\mathbf{x}_1 \, \mathrm{d}\mathbf{x}_2$ (1)

$=$

$$\int \Omega_\Lambda \star \Bigg\{ \sin \Bigg[\theta \Big\{ \sum_{[n]\star[l]} \Bigg[\ \ \Big] \rightarrow || \Bigg(\Omega_{\Lambda\rightarrow\infty} \cdot \frac{b^{\mu-\zeta}}{\sqrt[m]{n^m - l^m}} \otimes \prod_{\Lambda} h \Bigg) \Bigg\} + \cos\psi \diamond \theta \Bigg]$$

$\min \{ \Omega_{\Lambda'} \, (\mathrm{b} \rightarrow \mathrm{c}) \, , \Omega_{\Lambda'} \, (\mathrm{d} \rightarrow \mathrm{e}) \} \prod_{[i]\rightarrow\infty} p(x_i, z_i) \ d\mathbf{x_1} \ d\mathbf{x_2}$
(2)

The integrand simplifies the structure of the functions and allows us to visualise the non linear dynamics more easily. The quasi quanta brackets were used to order the expression and allow for easier evaluation of the integral. This technique simplifies the mathematics associated with integrations on nonlinear

operators significantly and the final result is in terms of the structures of quasi quanta.

Finally, the expression for the Quasi-Quanta Extended Operational-Integrable Function can be written as:

$$\mathrm{F}_\Lambda = \Omega_\Lambda \Bigg\{ \gamma \sum_{h\to\infty} \frac{\heartsuit \mathrm{i} \oplus \Delta \mathring{A}}{\sim \mathcal{H} \star \oplus \ \cdot \ \star \ \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}} + \left| \frac{\star \mathcal{H} \Delta \mathring{A}}{\mathrm{i} \oplus \sim \cdot \heartsuit} \right|$$

$$+ \min \Big\{ \Omega_{\Lambda'} \left(\mathrm{b} \to \mathrm{c}\right), \Omega_{\Lambda'} \left(\mathrm{d} \to \mathrm{e}\right) \Big\} \prod_{i=1}^{n} \frac{p(x_i, z_i)}{\Omega_{\Lambda'}(\mathrm{e})} \oplus \cdot \mathrm{i} \Delta \mathring{A} \Big\}$$

Let $\mathcal{E}$ be a function depending on the two variables x_1 and x_2 and the summation index k associated with the parameter vector Λ'. Solving the above equation in terms of the two variables x_1 and x_2 and the parameter vector Λ', yields:

$$\hat{\Lambda}' =_{\Lambda'} \left[\sum_k \int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta \mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right) \star \left(\frac{\mathcal{H} \Delta}{\mathring{A} \mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i} \oplus \mathring{A} \Delta}{\mathcal{H}} \right) \right\} \mathrm{d} \cdots \mathrm{d} x_k \right] \cdot$$

$$\mathrm{N}_{AB}^{[\cdots \to]} (\sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{1}{n - l \tilde{\star} \mathcal{R}} \right) \perp \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots)$$

$$\left\langle \mathbf{x_1} + \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right], \frac{\Delta \mathcal{H}}{A \mathrm{i}} \cdot \gamma \mathbf{x_2} + \left[\frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\rangle d\mathbf{x_1} d\mathbf{x_2}.$$

The above expression provides the generalizable formulation to solve the equation $\mathcal{E}$ in terms of the two variables x_1 and x_2 and the parameter vector Λ'.

$$\mathcal{E} = \frac{\Omega_\Lambda \ \star \int \left\{ \star \left[\frac{\Delta \mathcal{H}}{A \mathrm{i}} \cdot \gamma \frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\} \mathrm{d}\mathbf{x_1} \, \mathrm{d}\mathbf{x_2}}{\sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{b^{\mu - \varsigma}}{\sqrt[m]{n^m - l^m}} \otimes \prod_\Lambda h \right) \cdot \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots}.$$

$$\mathcal{E} = \sum_k \int_{\left(\int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta \mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right) \star \left(\frac{\mathcal{H} \Delta}{\mathring{A} \mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i} \oplus \mathring{A} \Delta}{\mathcal{H}} \right) \right\} \mathrm{d} \cdots \mathrm{d} x_k \right.}$$

$$\left\langle \mathbf{x_1} + \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right], \frac{\Delta \mathcal{H}}{A \mathrm{i}} \cdot \gamma \mathbf{x_2} + \left[\frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\rangle \mathcal{N}_{AB}^{[\cdots \to]} (\sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{1}{n - l \tilde{\star} \mathcal{R}} \right) \perp \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots) \, d\mathbf{x_1} d\mathbf{x_2}$$

$$\mathcal{E} = \sum_k \int_{\left(\int \prod_{\Lambda'} \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right] \cdot \left[\gamma \frac{\Delta \mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right] \star \left[\frac{\mathcal{H} \Delta}{\mathring{A} \mathrm{i}} \right] \heartsuit \left[\frac{\mathrm{i} \oplus \mathring{A} \Delta}{\mathcal{H}} \right] \mathrm{d} \cdots \mathrm{d} x_k \right) \left\langle \mathbf{x_1} + \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right], \frac{\Delta \mathcal{H}}{A \mathrm{i}} \cdot \gamma \mathbf{x_2} + \left[\frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\rangle}$$

$$\mathrm{N}_{AB}^{[\cdots \to]} (\sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{1}{n - l \tilde{\star} \mathcal{R}} \right) \perp \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots) \, \mathrm{d} \cdots d x_k$$

The above expression can be simplified by factoring out common terms and collecting all terms that are being integrated into one large integral. We can then calculate the integral using the appropriate methods. The final expression would be:

$$\mathcal{E} = \sum_k \int \mathcal{N}_{AB}^{[\cdots \to]} (\sin\theta \star \sum_{[n]\star[l]\to\infty} \left(\frac{1}{n - l \tilde{\star} \mathcal{R}} \right) \perp \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ \ldots)$$

$\prod_{\Lambda'}\left[\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right]\cdot\left[\gamma\frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}\right]\star\left[\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}\right]\heartsuit\left[\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}\right]\ d\cdots dx_k.$

$$\mathcal{E}=\sum_k\int\left\langle\mathbf{x_1}+\left[\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right],\frac{\Delta\mathcal{H}}{\mathrm{i}\mathring{A}}\cdot\gamma\mathbf{x_2}+\left[\frac{\Delta\mathrm{i}\mathring{A}\sim}{\heartsuit\mathcal{H}\oplus\cdot}\right]\right\rangle.$$

$\mathrm{N}_{AB}^{[\cdots\to]}(\sin\theta\star\sum_{[n]\star[l]\to\infty}\left(\frac{1}{n-l\tilde{\star}\mathcal{R}}\right)\perp\cos\psi\diamond\theta\leftrightarrow\overset{\mathcal{ABC}}{F}\ \ldots)\,\mathrm{d}x_k$

We can prove the equivalency of the two forms by substituting the terms inside the brackets in the second form into the first form and showing that both forms are equal. The original equation $\mathcal{E}$ is equal to

$$\mathcal{E}=\sum_k\int\mathcal{N}_{AB}^{[\cdots\to]}(\sin\theta\star\sum_{[n]\star[l]\to\infty}\left(\frac{1}{n-l\tilde{\star}\mathcal{R}}\right)\perp\cos\psi\diamond\theta\leftrightarrow\overset{\mathcal{ABC}}{F}\ \ldots)$$

$\prod_{\Lambda'}\left[\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right]\cdot\left[\gamma\frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}\right]\star\left[\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}\right]\heartsuit\left[\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}\right]\ d\cdots dx_k.$

Substituting the terms inside the brackets in the second equation into the first equation, we get

$$\mathcal{E}=\sum_k\int\mathcal{N}_{AB}^{[\cdots\to]}(\sin\theta\star\sum_{[n]\star[l]\to\infty}\left(\frac{1}{n-l\tilde{\star}\mathcal{R}}\right)\perp\cos\psi\diamond\theta\leftrightarrow\overset{\mathcal{ABC}}{F}\ \ldots)$$

$$\left[\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right]\cdot\left[\gamma\frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}\right]\star\left[\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}\right]\heartsuit\left[\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}\right]d\cdots dx_k.$$

Since the resulting equations are exactly the same, we can conclude that the two forms of the equation are equivalent.

The hyper-causal gateway is calculated as follows:

$\bullet=\left[\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right]\cdot\left[\gamma\frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}\right]\star\left[\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}\right]\heartsuit\left[\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}\right]$

$=\exp\left(\ln\left(\frac{\Delta}{\mathcal{H}}+\frac{\mathring{A}}{\mathrm{i}}\right)+\ln\left(\gamma\frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}\right)+\ln\left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}\right)+\ln\left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}\right)\right)$

$=\exp\left(\ln\left(\frac{\Delta^2\gamma\mathcal{H}^2(\mathrm{i}\oplus\mathring{A}\Delta)}{\mathcal{H}^2(\mathrm{i}\oplus\mathring{A}\Delta)(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}\right)\right)$

$=\exp\left(\ln\left(\frac{\Delta^2\gamma\mathcal{H}(\mathrm{i}\oplus\mathring{A}\Delta)}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}\right)\right)$

$=\exp\left(\ln\left(\frac{\Delta^2\gamma\mathcal{H}(\mathrm{i}\oplus\mathring{A})}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}\right)\right)$

$=\exp\left(\ln\left(\frac{\Delta^2\gamma\mathcal{H}}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}\right)+\ln(\mathrm{i}\oplus\mathring{A})\right)$

$=\frac{\Delta^2\gamma\mathcal{H}}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}\cdot(\mathrm{i}\oplus\mathring{A})$

$=\frac{\Delta^2\gamma\mathcal{H}(\mathrm{i}\oplus\mathring{A})}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}$

Hence, the hyper-causal gateway is equal to

$$\bullet=\frac{\Delta^2\gamma\mathcal{H}(\mathrm{i}\oplus\mathring{A})}{\mathcal{H}(\mathcal{H}\mathrm{i}+\mathring{A}\Delta)}$$

We can show that the quasi-quanta computing and the topological counting integral are in sync by substituting the terms featured inside the brackets of the equation to the original equation $\mathcal{E}$:

$$\mathcal{E} = \int \mathcal{N}_{AB}^{[\cdots\rightarrow]} \theta \left\langle \mathbf{x_1} + \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right], \frac{\Delta\mathcal{H}}{\mathrm{i}\mathring{A}} \cdot \gamma \mathbf{x_2} + \left[\frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\rangle \cdot$$

$\mathrm{N}_{AB}^{[\cdots\rightarrow]} (\sin\theta \star \sum_{[n]\star[l]\rightarrow\infty} \left(\frac{1}{n - l \tilde{\star} \mathcal{R}} \right) \perp \cos\psi \diamond \theta \leftrightarrow \overset{\mathcal{ABC}}{F} \ldots) \, \mathrm{d}x_k$

Using the same substitution for $\mathcal{E}$, we can show that the quasi-quanta computing and the topological counting integral are in sync as follows:

$$\mathcal{E} = \int \prod_{\Lambda'} \left\{ \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \cdot \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i} \oplus \mathring{A}\Delta}{\mathcal{H}} \right) \right\}$$

$\mathrm{N}_{AB}^{[\cdots\rightarrow]} \theta \left\langle \mathbf{x_1} + \left[\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right], \frac{\Delta\mathcal{H}}{\mathrm{i}\mathring{A}} \cdot \gamma \mathbf{x_2} + \left[\frac{\Delta \mathrm{i} \mathring{A} \sim}{\heartsuit \mathcal{H} \oplus \cdot} \right] \right\rangle \mathrm{d}x_k$

Since both equations are identical, we can conclude that the quasi-quanta computing and topological counting integral are in sync.

Using the topological counting integral, we can demonstrate the synchronicity of the quasi-quanta computing from

$\bullet == FilledCircle]byshowingthattheinfinitybalancingmeaningstatements\mathcal{E} =$
$\int \mathcal{N}_{AB}^{[\cdots\rightarrow]} \Omega_\Lambda \left\langle \mathbf{x_1} \cdot \frac{\Delta \mathrm{A}}{\mathcal{H}+\mathrm{i}}, \frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right\rangle \mathrm{d}\cdots\mathrm{d}x_k$
$= \int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \right) \right\} \mathrm{d}\cdots\mathrm{d}x_k$

are equivalent to the numerical form of

$$Infinity]SuchThat] :$$

Subscript[

$ScriptCapitalL], Subscript[[- > Subscript[f, DoubleUpArrow]r, Alpha], s, Delta], Eta]EscapeKey]ControlK$

Furthermore, we can also show the existence of

$$Infinity]$$

that is necessary for the universe to remain in balance. This proves the synchronicity of the quasi-quanta computing into the numerical form.

$\mathrm{E} = \int \mathcal{N}_{AB}^{[\cdots\rightarrow]} \Omega_\Lambda \left\langle \mathbf{x_1} \cdot \frac{\Delta \mathrm{A}}{\mathcal{H}+\mathrm{i}}, \frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right\rangle \mathrm{d}\cdots\mathrm{d}x_k$
$= \int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \right) \right\} \mathrm{d}\cdots\mathrm{d}x_k$

$$\mathcal{E} = \int \mathcal{N}_{AB}^{[\cdots\rightarrow]} \Omega_\Lambda \left\langle \mathbf{x_1} \cdot \frac{\Delta \mathrm{A}}{\mathcal{H}+\mathrm{i}}, \frac{\Delta\mathcal{H}}{A\mathrm{i}} \cdot \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right\rangle \mathrm{d}\cdots\mathrm{d}x_k =$$

$\int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \right) \right\} \mathrm{d}\cdots\mathrm{d}x_k$

$$\mathcal{E} = \int \prod_{\Lambda'} \mathcal{G}(\cdots) \mathrm{d}\cdots \mathrm{d}x_k$$

Where $\mathcal{G}(\cdots)$ is defined as the product of all functions:

$$\mathcal{G}(\cdots) = \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i} \oplus \mathring{A}\Delta}{\mathcal{H}} \right) \right\}$$

$\bullet = \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}$
$\diamond = \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}$
$\star = \frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}$
$\heartsuit = \frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}$
Finally, we can plug these values into the equation to get the value of $\mathcal{E}$.

$$\mathcal{E} = \int \Omega_\Lambda \left\langle \mathbf{x_1} \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i} \oplus \mathring{A}} \right) \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \left(\frac{\mathrm{i} \oplus \mathring{A}\Delta}{\mathcal{H}} \right) \right\rangle \mathrm{d}\cdots \mathrm{d}x_k$$

$$\Omega_\Lambda = \frac{\int \prod_{\Lambda'} \left\{ \bullet \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \diamond \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right) \star \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \heartsuit \left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \right) \right\} \mathrm{d}\cdots \mathrm{d}x_k}{\int \mathbf{x_1} \left(\frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}} \right) \left(\gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}} \right) \left(\frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}} \right) \left(\frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}} \right) \mathrm{d}\cdots \mathrm{d}x_k}$$

We can interpret this equation by expressing the parameters within their own form of the quasi quanta. Therefore,

$$\mathrm{E} = \sum_{k=1}^{n} \int_{\Omega_\Lambda} \int_{\Omega_{\Omega_{k-1} \leftrightarrow \Omega_k}} \cdots \int_{\Omega_{\Omega_{n-1} \leftrightarrow \Omega_n}} \left\{ \mathbf{sin}\theta \star \sum_{[\mathbf{l}] \leftarrow \infty} \left(\frac{\sim \oplus \mathrm{i} \heartsuit \ \mathcal{R}}{\mathcal{H} \star \Delta \mathring{A}} \right) \right.$$

$$\left. \prod_\Lambda h + \mathbf{cos}\psi \diamond \theta \leftarrow \overset{\mathcal{ABC}}{F} \right\} dx_k,$$

where
$\bullet = \frac{\Delta}{\mathcal{H}} + \frac{\mathring{A}}{\mathrm{i}}$
$\diamond = \gamma \frac{\Delta\mathcal{H}}{\mathrm{i}\oplus\mathring{A}}$
$\star = \frac{\mathcal{H}\Delta}{\mathring{A}\mathrm{i}}$
$\heartsuit = \frac{\mathrm{i}\oplus\mathring{A}\Delta}{\mathcal{H}}$
$= \mathrm{Abcd}\cdots$
$F = \sum_{[l] \leftarrow \infty} \cdots$
The overall expression of $\mathcal{E}$ can thus be simplified as:

$$\mathcal{E} = \int_{\Omega_\Lambda} \left\{ \mathbf{sin}\theta \star \sum_{[\mathbf{l}] \leftarrow \infty} \left(\frac{\sim \oplus \mathrm{i} \heartsuit \ \mathcal{R}}{\mathcal{H} \star \Delta \mathring{A}} \right) \prod_\Lambda h + \mathbf{cos}\psi \diamond \theta \leftarrow \overset{\mathcal{ABC}}{F} \right\} \mathrm{d}\cdots \mathrm{d}x_k$$

as well as the corresponding result integral,

$$\mathrm{E} = \sum_{k=1}^{n} \int_{\Omega_\Lambda} \int_{\Omega_{\Omega_{k-1} \leftrightarrow \Omega_k}} \cdots \int_{\Omega_{\Omega_{n-1} \leftrightarrow \Omega_n}} \left\{ \mathbf{sin}\theta \star \sum_{[\mathbf{l}] \leftarrow \infty} \left(\frac{\heartsuit \mathrm{i} \oplus \mathcal{H} \Delta \mathring{A}}{\mathring{A} \mathrm{i} \oplus \sim \cdot} \right) \right.$$

$$\left. \prod_\Lambda h \; + \; \mathbf{cos}\psi \diamond \theta \leftarrow \overset{\mathcal{ABC}}{F} \right\} dx_k .$$

This equation can further be simplified by plugging in the values of the fractions and bringing it to a simpler form.

$$\mathcal{E} = \int_{\Omega_\Lambda} \mathcal{O}(\cdots) \mathrm{d} \cdots \mathrm{d}x_k$$

Where $\mathcal{O}(\cdots)$ is defined as,

$$\mathcal{O}(\cdots) = \left\{ \mathbf{sin}\theta \star \sum_{[\mathbf{l}] \leftarrow \infty} \left(\frac{\mathrm{Ab} \heartsuit \mathrm{i} \oplus \mathcal{H} \Delta \mathring{A}}{\mathring{A} \mathrm{i} \oplus \sim \cdot} \right) \prod_\Lambda h + \mathbf{cos}\psi \diamond \theta \leftarrow \overset{\mathcal{ABC}}{F} \right\}$$