Making P manifestly polynomial ?

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Utilities

$$\text{CF}[\mathbb{E}[\omega\_, L\_, Q\_, P\_]] := \text{Expand} \mathbin{/@} \text{Together} \mathbin{/@} \mathbb{E}[\omega \mathbin{/.} b_{l\_} \mapsto \text{Log}[t_l], L, Q \mathbin{/.} b_{l\_} \mapsto \text{Log}[t_l], P \mathbin{/.} b_{l\_} \mapsto \text{Log}[t_l]];$$

$$\mathbb{E} \mathbin{/:} \mathbb{E}[\omega 1\_, L1\_, Q1\_, P1\_]\, \mathbb{E}[\omega 2\_, L2\_, Q2\_, P2\_] := \text{CF}@\mathbb{E}\left[\omega 1\, \omega 2,\ L1 + L2,\ \omega 2\, Q1 + \omega 1\, Q2,\ \omega 2^4\, P1 + \omega 1^4\, P2\right];$$

Normal Ordering Operators

$$N_{u_{i\_}\, c_{j\_} \to k\_}[\mathbb{E}[\omega\_, L\_, Q\_, P\_]] := \text{With}\Big[\{q = e^{-\gamma} \beta u_k + \gamma c_k\},\ \text{CF}\Big[\mathbb{E}\big[\omega,\ \gamma c_k + (L \mathbin{/.} c_j \to 0),\ \cancel{\omega} e^{-\gamma} \beta u_k + (Q \mathbin{/.} u_i \to 0),\ e^{-q}\, DP_{c_j \to D_\gamma, u_i \to D_\beta}[P][e^q]\big] \mathbin{/.} \{\gamma \to \partial_{c_j} L,\ \beta \to \cancel{\omega^{-1}}\, \partial_{u_i} Q\}\Big]\Big];$$

$$N_{w_{i\_}\, c_{j\_} \to k\_}[\mathbb{E}[\omega\_, L\_, Q\_, P\_]] := \text{With}\Big[\{q = e^{\gamma} \alpha w_k + \gamma c_k\},\ \text{CF}\Big[\mathbb{E}\big[\omega,\ \gamma c_k + (L \mathbin{/.} c_j \to 0),\ \cancel{\omega} e^{\gamma} \alpha w_k + (Q \mathbin{/.} w_i \to 0),\ e^{-q}\, DP_{c_j \to D_\gamma, w_i \to D_\alpha}[P][e^q]\big] \mathbin{/.} \{\gamma \to \partial_{c_j} L,\ \alpha \to \cancel{\omega^{-1}}\, \partial_{w_i} Q\}\Big]\Big];$$

$$N_{w_{i\_}\, u_{j\_} \to k\_}[\mathbb{E}[\omega\_, L\_, Q\_, P\_]] := \text{With}\Big[\{q = (1 - t_k)\, \mu^{-1} \alpha \underset{W}{\cancel{\beta}} + \mu^{-1} \beta u_k + \mu^{-1} \delta u_k w_k + \mu^{-1} \alpha w_k\},\ \text{CF}\Big[\mathbb{E}\big[\mu \cancel{\omega},\ L,\ \mu \cancel{\omega} q + \mu\, (Q \mathbin{/.} w_i \mid u_j \to 0),\ W\ \ W^{-4} \mu^4\, e^{-q}\, DP_{w_i \to D_\alpha, u_j \to D_\beta}[P][e^q] + \omega^4 \Lambda[k]\big] \mathbin{/.} \mu \to W + (t_k - 1)\, \delta \mathbin{/.} \{\alpha \to \cancel{\omega^{-1}} (\partial_{w_i} Q \mathbin{/.} u_j \to 0),\ \beta \to \cancel{\omega^{-1}} (\partial_{u_j} Q \mathbin{/.} w_i \to 0),\ \delta \to \cancel{\omega^{-1}}\, \partial_{w_i, u_j} Q\}\Big]\Big];$$

$$\Lambda[k\_] := (1 - t_k)\left(\alpha^2 \beta^2 + 4 \alpha \beta \delta \mu + 2 \delta^2 \mu^2\right)/2 + 2 \mu^2 (\alpha \beta + \delta \mu)\, c_k - \beta (2\mu - 1)(\alpha \beta + 2 \delta \mu)\, u_k + 2 \beta \delta \mu^2 c_k u_k - \beta^2 \delta (3 \mu - 1)\, u_k^2/2 + \alpha (\alpha \beta + 2 \delta \mu)\, w_k + 2 \alpha \delta \mu^2 c_k w_k - 2 (t_k - 1)\, \delta^2 (\alpha \beta + \delta \mu)\, u_k w_k + 2 \delta^2 \mu^2 c_k u_k w_k - \beta \delta^2 (2 \mu - 1)\, u_k^2 w_k + \alpha^2 \delta (1 + \mu)\, w_k^2/2 + \alpha \delta^2 u_k w_k^2 - (t_k - 1)\, \delta^4 u_k^2 w_k^2/2;$$

The Λόγος