

(* $\mathbb{E}[Q,P]$ means $e^Q P$ *)

$\mathbb{E} /: \text{Zip}_{\zeta s_List} @ \mathbb{E}[Q_, P_] :=$

Module[{ ζ , z, zs, c, ys, ηs , qt, zrule, Q1, Q2},

zs = Table[ζ^* , { ζ , ζs }];

c = Q /. Alternatives @@ ($\zeta s \cup zs$) \rightarrow 0;

ys = Table[∂_{ζ} (Q /. Alternatives @@ zs \rightarrow 0), { ζ , ζs }];

ηs = Table[∂_z (Q /. Alternatives @@ $\zeta s \rightarrow$ 0), {z, zs}];

qt = Inverse@Table[K δ_{z, ζ^*} - $\partial_{z, \zeta} Q$, { ζ , ζs }, {z, zs}];

zrule = Thread[zs \rightarrow qt . (zs + ys)];

Q1 = c + ηs . zs /. zrule;

Q2 = Q1 /. Alternatives @@ zs \rightarrow 0;

Simplify /@ $\mathbb{E}[Q2, \text{Det}[qt] e^{-Q2} \text{Zip}_{\zeta s} [e^{Q1} (P /. zrule)]]];$