Notes for Paper 53:

Tensorial Linear Inhomogeneous Equation

$$\partial_\mu F^{a\mu\nu} + \omega^a{}_{\mu b} F^{b\mu\nu} = A^{(0)} R^a{}_b{}^{\mu\nu} q^b{}_\mu \quad - (1)$$

$$\partial_\mu \tilde{F}^{a\mu\nu} + \omega^a{}_{\mu b} \tilde{F}^{b\mu\nu} = A^{(0)} \tilde{R}^a{}_b{}^{\mu\nu} q^b{}_\mu \quad - (2)$$

$$F^{a\mu\nu} = \partial^\mu A^{a\nu} - \partial^\nu A^{a\mu} + \omega^{a\mu}{}_b A^{b\nu} - \omega^{a\nu}{}_b A^{b\mu} \quad - (3)$$

Eq (1) leads to the unified Coulomb and Ampère Maxwell Laws and Eq (2) to the unified Gauss and Faraday laws.

From (3) in (1) the linear inhomogeneous structure is:

$$\begin{aligned}
&\square A^{a\nu} - \partial^\nu \left(\partial_\mu A^{a\mu} \right) \\
&+ \omega^{a\mu}{}_b \partial_\mu A^{b\nu} - \omega^{a\nu}{}_b \partial_\mu A^{b\mu} + \omega^a{}_{\mu b} \left(\partial^\mu A^{b\nu} - \partial^\nu A^{b\mu} \right) \\
&+ \left(\partial_\mu \omega^{a\mu}{}_b \right) A^{b\nu} - \left(\partial_\mu \omega^{a\nu}{}_b \right) A^{b\mu} \\
&+ \omega^a{}_{\mu b} \omega^{b\mu}{}_c A^{c\nu} - \omega^a{}_{\mu b} \omega^{b\nu}{}_c A^{c\mu} \\
&= A^{(0)} R^a{}_b{}^{\mu\nu} q^b{}_\mu \\
&= A^{(0)} R^{a\mu\nu}{}_\mu \qquad - (4)
\end{aligned}$$