Remark 0.0.1. Analogous to ODE, we can consider the integration factor given by

$$Y_t = \Phi_t^{-1} = \exp\left(-\int_0^t A_s\, ds - \int_0^t \boldsymbol{B}_s\, d\boldsymbol{W}_s + \frac{1}{2}\int_0^t \boldsymbol{B}_s^\top\, \boldsymbol{B}_s\, ds\right)$$