The Levy-area process A of a d-dimensional Brownian motion W is given by $A_t^{i,j} := \frac{1}{2}(\int_0^t W_u^i dW_u^j - \int_0^t W_u^j dW_u^i)$. It is the unique process (in law) which obeys the following version of Chen's relation:

$$A_{0,t}^{i,j} = A_{0,s}^{i,j} + A_{s,t}^{i,j} + \frac{1}{2}\left(W_{0,s}^i W_{s,t}^j - W_{0,s}^j W_{s,t}^i\right)$$

for $0 \leq s \leq t$.

1 Brownian bridge flipping

$$A_{s,t} = H_{s,t} \otimes W_{s,t} - W_{s,t} \otimes H_{s,t} + b_{s,t}$$

$$A_{s,t}^{i,j} = H_{s,t}^i W_{s,t}^j - W_{s,t}^i H_{s,t}^j + b_{s,t}^{i,j}$$

$$b_{s,t}^{i,j} := \int_s^t B_{s,u}^i \circ dB_u^j$$

$$\widetilde{A}_{s,t}^{i,j} = c_i H_{s,t}^i W_{s,t}^j - c_j W_{s,t}^i H_{s,t}^j + c_i c_j \widetilde{b}_{s,t}^{i,j} \quad \text{for } \mathbf{c} \in \{-1,1\}^d$$