Periodic Potential Field

- Under periodic side boundary condition, **B** field can be separated into two parts, $\mathbf{B} = \mathbf{B}_0 + \mathbf{B}_c$.

  - $(\mathbf{B} - \mathbf{B}_0) \cdot \hat{\mathbf{n}}\big|_{\text{side boundary}} \neq 0$, $\mathbf{B}_0$ can **NOT** be chosen as $\mathbf{B}_R$.

  - $\underline{\mathbf{B}_0 \text{ has a lower energy than } \mathbf{B}_p}$.

    - As $\mathbf{B}_p = \mathbf{B}_0 + \mathbf{B}_{p1}$, the cross term in the energy calculation vanished by the boundary condition.

Newly Defined Helicity

- Following the definition of the classical relative magnetic helicity.

- The field $\mathbf{B}_c$ can be further separated as $\mathbf{B}_{p1} + \mathbf{B}_{c1}$

  ,where $(\mathbf{B}_{p1} - \mathbf{B}_c) \cdot \hat{\mathbf{n}}|_{\partial\Omega} = 0$, and $\mathbf{B}_{c1} = \mathbf{B}_c - \mathbf{B}_{p1}$