mean-field solution 을 얻는 다른방법. (P367, Fazekas).
같음을 증명할수 있다.!!

We can regard m as a variational parameter, and determine it by requiring that $E(m)$ be minimum

$$\frac{\partial E(m)}{\partial m} = 0$$

$$E(m) = U\left(\frac{n^2}{4} + m^2\right) - \frac{2}{L}\sum_{\vec{k}}^{occ.} \sqrt{\varepsilon_k^2 + U^2 m^2} \quad \cdots (1)$$

$$\frac{\partial E(m)}{\partial m} = 2Um - \frac{1}{L}\sum_{\vec{k}}^{occ.} \frac{2U^2 m}{\sqrt{\varepsilon_k^2 + U^2 m^2}} = 0.$$

two solution $m = 0$,

or m is determined by the gap equation

$$1 = \frac{1}{L}\sum_{\vec{k}}^{occ.} \frac{U}{\sqrt{\varepsilon_k^2 + \Delta^2}}.$$

where $\Delta = mU$

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(1) 결과는 여기서 나오나 면

$$H_{\vec{k}} = \begin{pmatrix} \tilde{\varepsilon}_{\vec{k}} & -Um\eta(6) \\ -Um\eta(6) & \tilde{\varepsilon}_{\vec{k}+\vec{Q}} \end{pmatrix}$$ 을 대각화 해서

$$\tilde{\varepsilon}_{\vec{k}} = \frac{Un}{2} + \varepsilon_{\vec{k}}$$

perfect nesting $\varepsilon_{\vec{k}+\vec{Q}} = -\varepsilon_{\vec{k}}$ 에 따라

$$\lambda^{\pm}(\vec{k}) = \frac{Un}{2} \pm \sqrt{\varepsilon_k^2 + U^2 m^2}.$$