

クーロン場

$\forall f \in F_3; \forall Y \in F_{2,1}; \forall q \in \mathbb{R}(1); [[1] \text{ and } [2]] \Rightarrow e_3(f, Y, q)$

【1】 $\forall (t, i, 1) \in N_{2,1}; Y(t, i, 1) = 0$

【2】 $\forall \xi \in N_{0,1}; \forall i \in \mathfrak{Z};$

$$f(\xi, i, 1) = [q(1)/4\pi] \gamma(i; \xi(\mathfrak{Z}), 0) \text{ and } f(\xi, i, 2) = 0$$

リエナール・ヴィーヘルトの解

$\forall f \in F_3; \forall Y \in F_{2,1}; \forall q \in \mathbb{R}(1); [[1] \text{ or } [2]] \Rightarrow e_3(f, Y, q)$

【1】 $\forall \xi \in N_{0,1}; \forall t \in \mathbb{R}(\{4\}); \forall r, n, \dot{z}, \ddot{z} \in \mathbb{R}(\mathfrak{Z}); [1a] \Rightarrow [1b]$

【1a】 $t(4) = \xi(4) - |r| \text{ and } r = \xi(\mathfrak{Z}) - Y(t, \square, 1) \text{ and } n = r/|r| \text{ and}$

$\dot{z} = \partial_4 Y(t, \square, 1) \text{ and } \ddot{z} = \partial_4 \partial_4 Y(t, \square, 1)$

$$[1b] f(\xi, \square, 1) = \frac{q(1)}{4\pi} \left[\frac{(1 - |\dot{z}|^2)(n - \dot{z})}{|r|^2(1 - n \cdot \dot{z})^3} - \frac{n \times [\ddot{z} \times (n - \dot{z})]}{|r|(1 - n \cdot \dot{z})^3} \right] \text{ and}$$

$$f(\xi, \square, 2) = -\frac{q(1)}{4\pi} \left[\frac{(1 - n \cdot \dot{z})(n \times \ddot{z}) + (n \cdot \ddot{z})(n \times \dot{z})}{|r|(1 - n \cdot \dot{z})^3} + \frac{(1 - |\dot{z}|^2)(n \times \dot{z})}{|r|^2(1 - n \cdot \dot{z})^3} \right]$$

【2】 $\forall \xi \in N_{0,1}; \forall t \in \mathbb{R}(\{4\}); \forall r, n, \dot{z}, \ddot{z} \in \mathbb{R}(\mathfrak{Z}); [2a] \Rightarrow [2b]$

【2a】 $t(4) = \xi(4) + |r| \text{ and } r = \xi(\mathfrak{Z}) - Y(t, \square, 1) \text{ and } n = r/|r| \text{ and}$

$\dot{z} = \partial_4 Y(t, \square, 1) \text{ and } \ddot{z} = \partial_4 \partial_4 Y(t, \square, 1)$

$$[2b] f(\xi, \square, 1) = \frac{q(1)}{4\pi} \left[\frac{(1 - |\dot{z}|^2)(n + \dot{z})}{|r|^2(1 + n \cdot \dot{z})^3} - \frac{n \times [\ddot{z} \times (n + \dot{z})]}{|r|(1 + n \cdot \dot{z})^3} \right] \text{ and}$$

$$f(\xi, \square, 2) = \frac{q(1)}{4\pi} \left[\frac{(1 + n \cdot \dot{z})(n \times \ddot{z}) - (n \cdot \ddot{z})(n \times \dot{z})}{|r|(1 + n \cdot \dot{z})^3} - \frac{(1 - |\dot{z}|^2)(n \times \dot{z})}{|r|^2(1 + n \cdot \dot{z})^3} \right]$$

クーロン場はリエナール・ヴィーヘルトの解で $Y = 0$ とした特別の場合になっている。