1 Canonical Quantization

For the quantization of the electromagnetic field you just need to make a mode expansion of $\vec{A}$, which leads to

$$\hat{\vec{A}}(x) = \sum_J \sum_{\lambda=1}^{2} \frac{1}{\sqrt{\omega_J}} \vec{\varepsilon}_{J,\lambda} \left(\mathrm{e}^{-\mathrm{i}\omega_J t} \tilde{\mathcal{A}}_{J,\lambda}(\vec{r}) \, \hat{a}_{J,\lambda} + \mathrm{e}^{\mathrm{i}\omega_J t} \tilde{\mathcal{A}}^*_{J,\lambda}(\vec{r}) \, \hat{a}^\dagger_{J,\lambda} \right) .$$

2 Integral Theorems

The *Gauß-Ostrogradski* and *Green* theorem are shown below:

$$\int_V \operatorname{div} \vec{F} \, \mathrm{d}^n V = \oint_S \vec{F} \cdot \vec{n} \, \mathrm{d}^{n-1} S \,, \tag{1}$$

$$\iint_D \left(\frac{\partial g}{\partial x}(x,y) - \frac{\partial f}{\partial y}(x,y) \right) \mathrm{d}x \, \mathrm{d}y = \oint_C \left(f(x,y) \, \mathrm{d}x + g(x,y) \, \mathrm{d}y \right) \tag{2}$$