<u>Hamiltonian</u> : to simplify, fix the gauge $\longrightarrow$ conformal gauge : $h_{ab} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

use flat background $\longrightarrow$ $g_{\mu\nu} = \eta_{\mu\nu}$.

$$S = \frac{T}{2} \int d^2\sigma \sqrt{h}\, h^{ab}\, \partial_a X^\mu \partial_b X^\nu g_{\mu\nu} =$$

$$= \frac{T}{2} \int d^2\sigma \left(\dot{X}^2 - X'^2 \right) \quad , \text{ where } \begin{cases} \dot{X} = \dfrac{\partial X}{\partial \sigma^0} \\ X' = \dfrac{\partial X}{\partial \sigma^1} \end{cases}$$

the eqn of motion wrt h^{ab} (the "string energy momentum tensor") is :

$$\frac{\delta S}{\delta h^{ab}} = T\sqrt{h} \left(\partial_a X^\mu \partial_b X^\nu g_{\mu\nu} - \frac{1}{2} h_{ab} h^{cd} \partial_c X^\mu \partial_d X^\nu g_{\mu\nu} \right) =$$

$$= \frac{T}{2} \begin{pmatrix} \dot{X}^2 + X'^2 & 2X'\dot{X} \\ 2X'\dot{X} & \dot{X}^2 + X'^2 \end{pmatrix}_{ab} = 0 \Longrightarrow \begin{cases} \dot{X}^2 + X'^2 = 0 \\ \dot{X}^\mu X'_\mu = 0 \end{cases} \quad \text{two constraints}$$

(using the conformal gauge)