where p is the longitudinal load and q is the transverse load. Via the Hamilton's principle, we have the equations of motion

$$\begin{aligned}
&u_{xx}(c_{11}-\frac{d_{31}^2}{a_{33}})+u_{zz}(c_{55}-\frac{d_{15}^2}{a_{11}})+w_{xz}(c_{13}+c_{55}-\frac{d_{15}^2}{a_{11}})-\varphi_{xz}(\frac{d_{31}}{a_{33}}+\frac{d_{15}}{a_{11}})+\\
&w_{xxx}(\frac{d_{15}}{a_{11}}f_{1111}-\frac{d_{31}}{a_{33}}f_{1313})+\frac{f_{1331}}{a_{11}}d_{15}u_{zzz}-w_{xzz}(\frac{d_{31}}{a_{33}}f_{3333}+\frac{d_{15}}{a_{11}}f_{1331})\\
&\frac{f_{1111}}{a_{11}}[\varphi_{xxx}+f_{1111}u_{xxxx}+f_{1331}(u_{xxzz}+w_{xxzz})+f_{3311}w_{xxxz}]\\
&\frac{f_{1331}}{a_{11}}[\varphi_{xzz}+f_{1111}u_{xxzz}+f_{1331}(u_{zzzz}+w_{xzzz})+f_{3311}w_{xzzz}]\\
&\frac{f_{1133}+f_{1313}}{a_{33}}[\varphi_{xzz}+f_{1133}u_{xxzz}+f_{1313}(u_{xxzz}+w_{xxxz})+f_{3333}w_{xzzz}]-p=\varrho\ddot{u},\\
&w_{xx}(c_{55}-\frac{d_{15}^2}{a_{11}})+w_{zz}c_{33}+u_{xz}(c_{13}+c_{55}-\frac{d_{15}^2}{a_{11}})\\
&-\frac{d_{15}}{a_{11}}\varphi_{xx}-\frac{d_{15}}{a_{11}}f_{3311}w_{xxz}+u_{xxx}(\frac{d_{31}}{a_{33}}f_{1313}-\frac{d_{15}}{a_{11}}f_{1111})-\\
&\frac{f_{1313}}{a_{33}}[\varphi_{xxz}+f_{1133}u_{xxxz}+f_{1313}(u_{xxxz}+w_{xxxx})+f_{3333}w_{xxzz}]+\\
&\frac{f_{1331}}{a_{11}}[\varphi_{xxz}+f_{1111}u_{xxxz}+f_{1331}(u_{xzzz}+w_{xxzz})+f_{3311}w_{xxzz}]\\
&\frac{f_{3333}}{a_{33}}[\varphi_{zzz}+f_{1133}u_{xzzz}+f_{1313}(u_{xzzz}+w_{xxzz})+f_{3333}w_{zzzz}]-q=\varrho\ddot{w},\\
&\varphi_{xx}(\frac{3}{a_{11}}-\varepsilon_0)+\varphi_{zz}(\frac{3}{a_{33}}-\varepsilon_0)-u_{xz}(\frac{d_{15}}{a_{11}}+\frac{d_{31}}{a_{33}})-\frac{d_{15}}{a_{11}}w_{xx}-\\
&\frac{f_{1111}}{a_{11}}u_{xxx}-\frac{f_{3333}}{a_{33}}w_{zzz}-u_{xzz}(\frac{f_{1331}}{a_{11}}+\frac{f_{1313}}{a_{33}})+w_{xxz}(\frac{f_{1331}}{a_{11}}+\frac{f_{3311}}{a_{11}}+\frac{f_{1313}}{a_{33}})=0
\end{aligned}\tag{23}$$

with the boundary conditions presented for the brevity sake in the form of partial derivatives of the electric enthalpy function as: at $x=0$

$$u=u_x^{'}=w=w_x^{'}=\varphi=0,\tag{24}$$

at $x=l$

$$\begin{aligned}
&\frac{\partial H}{\partial u_x}-\frac{\partial}{\partial x}(\frac{\partial H}{\partial u_{xx}})-\frac{1}{2}\frac{\partial}{\partial z}\frac{\partial H}{\partial u_{xz}}=P_*,\\
&\frac{\partial H}{\partial u_{xx}}=0,\\
&\frac{\partial H}{\partial w_x}-\frac{\partial}{\partial x}(\frac{\partial H}{\partial w_{xx}})-\frac{1}{2}\frac{\partial}{\partial z}\frac{\partial H}{\partial w_{xz}}=0,\\
&\frac{\partial H}{\partial w_{xx}}=0,\\
&\frac{\partial H}{\partial \varphi_x}=0,
\end{aligned}\tag{25}$$