Contribution of spring S

$$k_{ij}^S = a^S(\varphi_i, \varphi_j) = S \cdot \varphi_i(L) \cdot \varphi_j(L)$$

$$\varphi_i(L) \cdot \varphi_j(L) = \begin{cases} 1 & \text{if } i = j = N \\ \\ 0 & \text{otherwise} \end{cases}$$

$$K^S = S \cdot \begin{bmatrix} 0 & 0 & 0 & \cdots & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & 0 \\ \\ 0 & 0 & 0 & \cdots & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & 1 \end{bmatrix}$$