$$
\mathbf{K}_b = \begin{bmatrix}
\mathbf{K}_{1,1}^{(1)} + \mathbf{K}_{1,1}^{(2)} & \mathbf{K}_{1,2}^{(2)} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} \\
\mathbf{K}_{2,1}^{(2)} & \mathbf{K}_{2,2}^{(2)} + \mathbf{K}_{2,2}^{(3)} & \mathbf{K}_{2,3}^{(3)} & \mathbf{0} & \vdots & \vdots & \vdots \\
\mathbf{0} & \vdots & \ddots & \vdots & \mathbf{0} & \vdots & \vdots \\
\vdots & \mathbf{0} & \mathbf{K}_{i,i-1}^{(i)} & \mathbf{K}_{i,i}^{(i)} + \mathbf{K}_{i,i}^{(i+1)} & \mathbf{K}_{i,i+1}^{(i+1)} & \mathbf{0} & \vdots \\
\vdots & \vdots & \mathbf{0} & \vdots & \ddots & \vdots & \mathbf{0} \\
\vdots & \vdots & \vdots & \mathbf{0} & \mathbf{K}_{n-1,n-2}^{(n-1)} & \mathbf{K}_{n-1,n-1}^{(n-1)} + \mathbf{K}_{n-1,n-1}^{(n)} & \mathbf{K}_{n-1,n}^{(n)} \\
\mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{K}_{n,n-1}^{(n)} & \mathbf{K}_{n,n}^{(n)}
\end{bmatrix} \tag{18}
$$

whereby it applies:

$$
\mathbf{K}_{j,k}^{(i)} = \begin{bmatrix}
\frac{\partial^2 \Pi_{b_i}}{\partial y_j \partial y_k} & \frac{\partial^2 \Pi_{b_i}}{\partial y_j \partial \varphi_k} \\
\frac{\partial^2 \Pi_{b_i}}{\partial \varphi_j \partial y_k} & \frac{\partial^2 \Pi_{b_i}}{\partial \varphi_j \partial \varphi_k}
\end{bmatrix} \in R^{2\times 2}, \tag{19}
$$