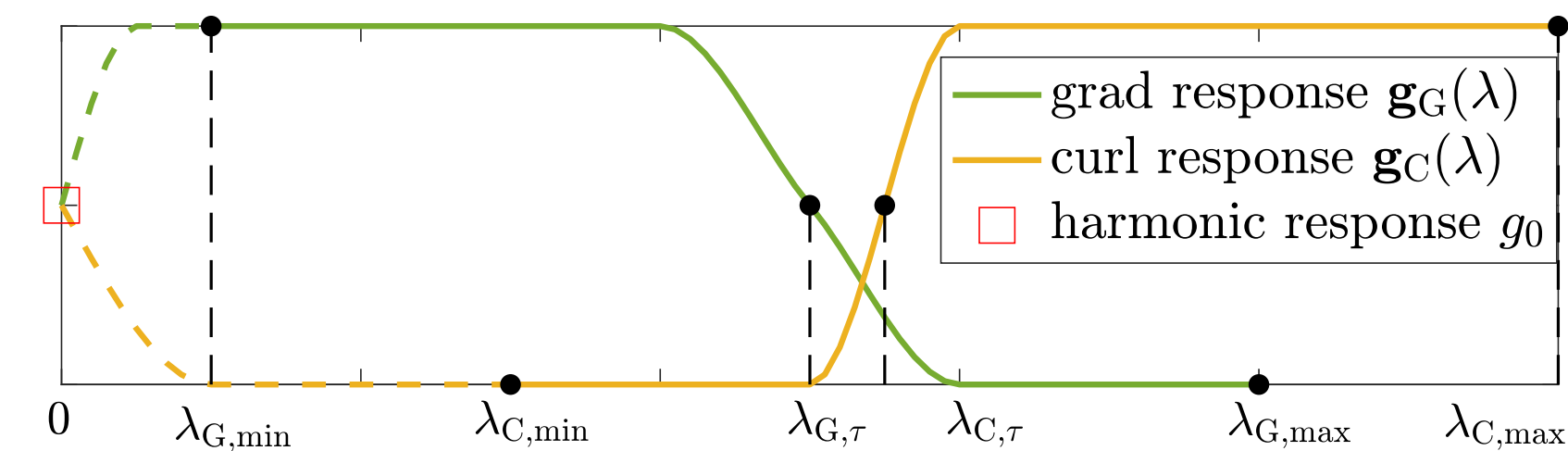


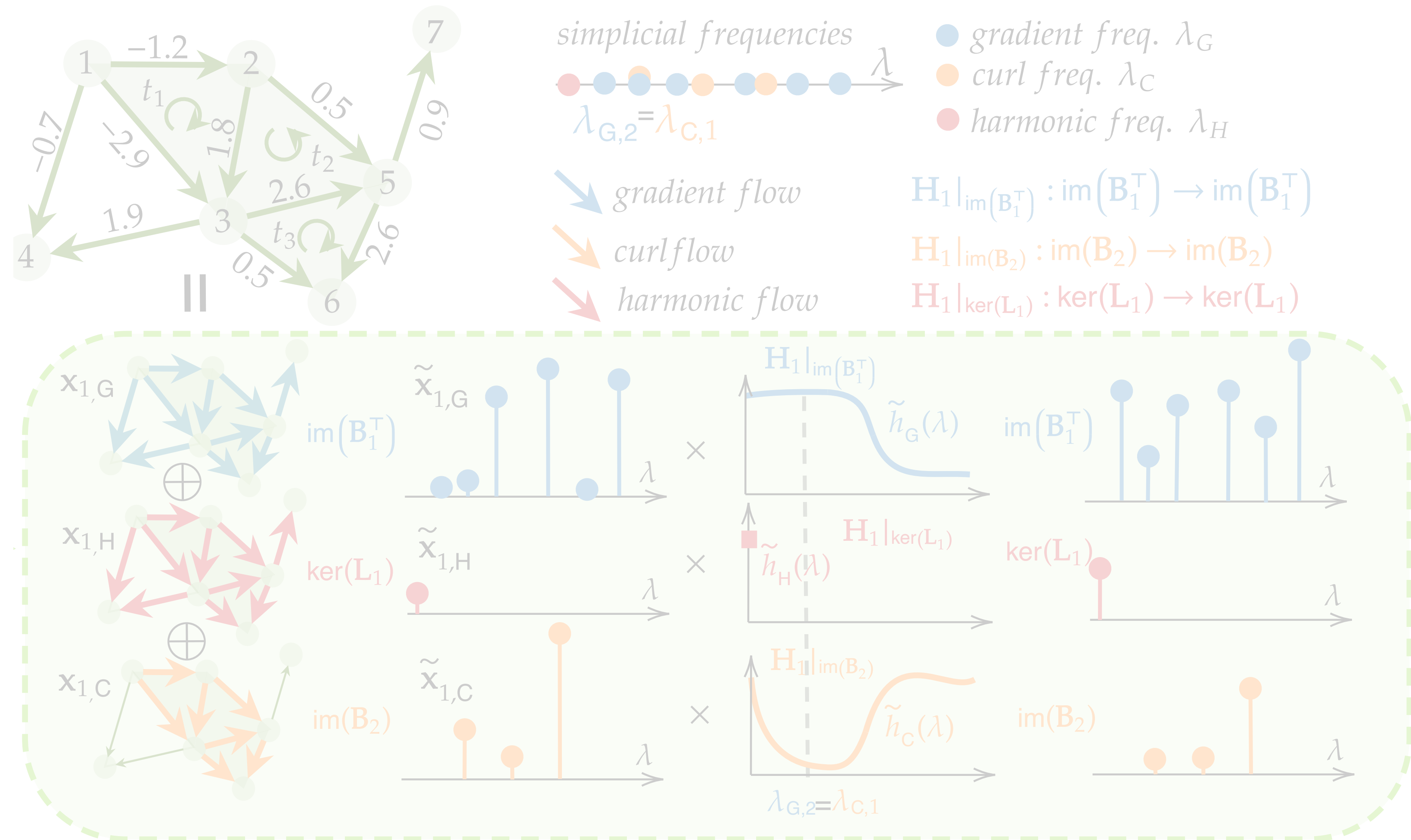
# Edge Convolutions on SCs

## Pointwise Multiplication at frequencies

$$\begin{cases} \tilde{H}_H(\lambda) = \alpha_0 + \beta_0, & \text{for } \lambda \in \mathcal{Q}_H, \\ \tilde{H}_G(\lambda) = \sum_{k=0}^{K_d} \alpha_k \lambda^k, & \text{for } \lambda \in \mathcal{Q}_G, \\ \tilde{H}_C(\lambda) = \sum_{k=0}^{K_u} \beta_k \lambda^k, & \text{for } \lambda \in \mathcal{Q}_C \end{cases}$$

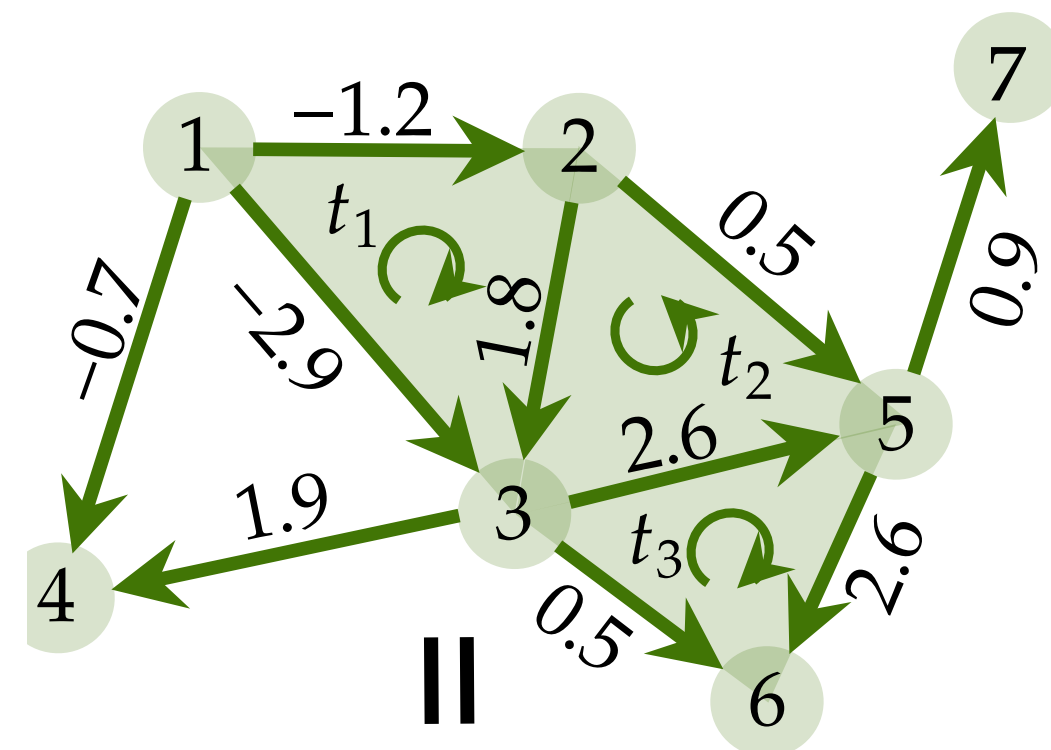


Why two sets of coefficients instead of one set?

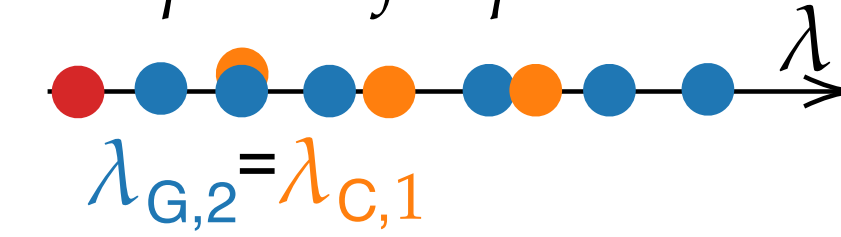


# Edge Convolutions on SCs

## Pointwise Multiplication at frequencies



simplicial frequencies  $\lambda$



- gradient freq.  $\lambda_G$
- curl freq.  $\lambda_C$
- harmonic freq.  $\lambda_H$

gradient flow

curlflow

harmonic flow

$$\mathbf{H}_1|_{\text{im}(\mathbf{B}_1^T)} : \text{im}(\mathbf{B}_1^T) \rightarrow \text{im}(\mathbf{B}_1^T)$$

$$\mathbf{H}_1|_{\text{im}(\mathbf{B}_2)} : \text{im}(\mathbf{B}_2) \rightarrow \text{im}(\mathbf{B}_2)$$

$$\mathbf{H}_1|_{\text{ker}(\mathbf{L}_1)} : \text{ker}(\mathbf{L}_1) \rightarrow \text{ker}(\mathbf{L}_1)$$

