$$2\langle \mathcal{P}(\mathcal{A}+\mathcal{L}_{\mathcal{G}})e, e\rangle = 2\beta \int_0^1 e^T P \frac{d^2}{dx}e + 2\alpha \int_0^1 e^T Pe + 2\int_0^1 e^T PGLe = 2\beta e^T P \frac{d}{dx}\begin{pmatrix} 1 \\ 0 \end{pmatrix} - 2\beta \int_0^1 \frac{d}{dx} e^T P \frac{d}{dx} e + 2\alpha \int_0^1 e^T Pe +$$