APPROXIMATE THEN PROJECT (AP)

$$\mathbf{F}_{N_h \times 1} \approx \mathbf{F}^{\text{approx}}_{N_h \times 1} = \mathsf{U}^{f}_{N_h \times r} \hat{\mathbf{F}}_{r \times 1}$$

$$\mathbf{F}^{\text{approx}}_{n} = \widetilde{\mathsf{U}}^{\top} \mathbf{F}^{\text{approx}}$$

Projected nonlinearity

Sparse measurement of full order nonlinearity

Empirical basis functions for interpolation

PROJECT THEN APPROXIMATE (PA)

$$\mathbf{F}_{n} = \sum_{e=1}^{n_e} \widetilde{\mathsf{U}}^{e^T} \mathbf{f}^{e}_{int}(\mathbf{w})$$

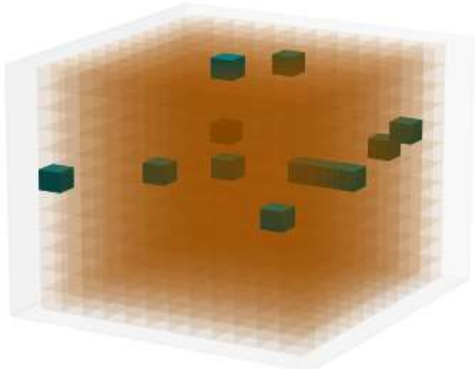
$$\mathbf{F}^{\text{approx}}_{n} = \sum_{e \in E} \xi_e \widetilde{\mathsf{U}}^{e^T} \mathsf{f}^{e}_{int}(\mathbf{w})$$

Projected nonlinearity

Sparse sampling of mesh elements preserving sum of reduced elemental contributions

EIM | **MPE** | **BPI**

DEIM | **GNAT** | **S-OPT**



ECSW | **ECM** | **EQP**