

Mutual Coupling IV Curse or Blessing?

Peter Timbie

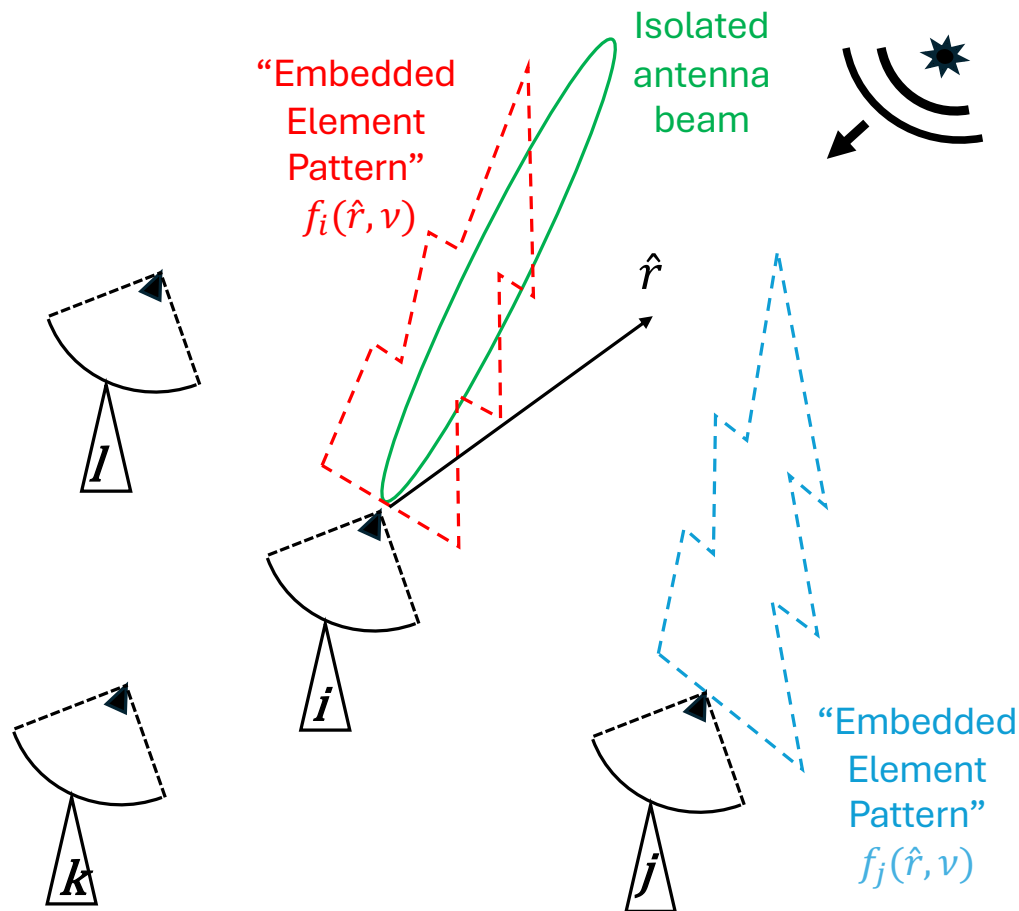
Tianlai Collaboration Telecon

11 November 2025

The Tianlai Pathfinders



The ‘Beam Overlap Matrix $\mathbf{B}$ ’ is related to the scattering ($\mathbf{S}$) parameters of the array



$$B_{ij} = \frac{1}{2\eta} \int f_i(\hat{r}, v) f_j^*(\hat{r}, v) d\Omega$$

Beam Overlap Matrix (single polarization)
 η = impedance of free space

$$\mathbf{B} = \frac{1}{8\text{Re}\{Z_L\}} (\mathbf{I} - \mathbf{S}^T \mathbf{S}^*)$$

Scattering matrix $\mathbf{S}$ (lossless array)

Craeye & Gonzalez-Ovejero “A Review on Array Mutual Coupling Analysis” Radio Science 46 (2011)

Array scattering matrix

$$\boldsymbol{v}^- = \boldsymbol{S}\boldsymbol{v}^+$$

