EDISON

Electromagnetic Design of
flexIble SensOrs

FNP Team-Tech

Report 94 fast CISS for Dispersive Surface Boundary Conditions

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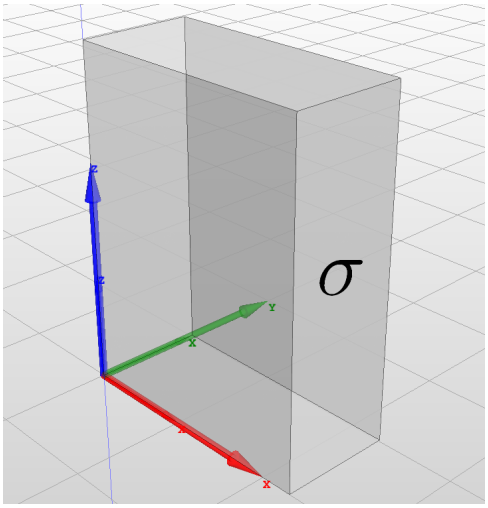

Figure 1: Resonator with dispersive surface boundary conditions.

1 Test Structure

- Resonator ($22.86 \times 10.16 \times 30$ mm) with dispersive surface boundary conditions: $\sigma = 5800$
- Problem size = 362678

2 Eigenproblem

The **nonlinear** eigenproblem is defined as follows:

$$(\mathbf{\Gamma} + s\gamma(s)\mathbf{G} + s^2\mathbf{C})\mathbf{E}(s) = 0. \tag{1}$$

where $s = j\omega/c = jk_0$ is a frequency parameter and $\gamma(s)$ is a scalar function modeling the dispersion of the surface impedance.

3 SLEPC CISS

- asp ratio = 0.1;
- radius = ca. 3.8GHz;
- center = ca. 12GHz;
- **More than 50 GB RAM required, too slow...**

4 Inhouse CISS

- integration points: $nc = 40$
- size of left/right probing space (random vectors): 11
- number of moments: 2
- computational time: 706.0s

l	$\|\|\mathbf{T}(k)\cdot\mathbf{x}\|\|/\|k\|$	f[GHz]
1	1e-13	8.190395959931 + 0.052963326910i
2	1e-13	11.890412063681 + 0.061543107090i
3	1e-13	13.962144599215 + 0.071396538547i
4	1e-13	15.483001263885 + 0.093268182955i

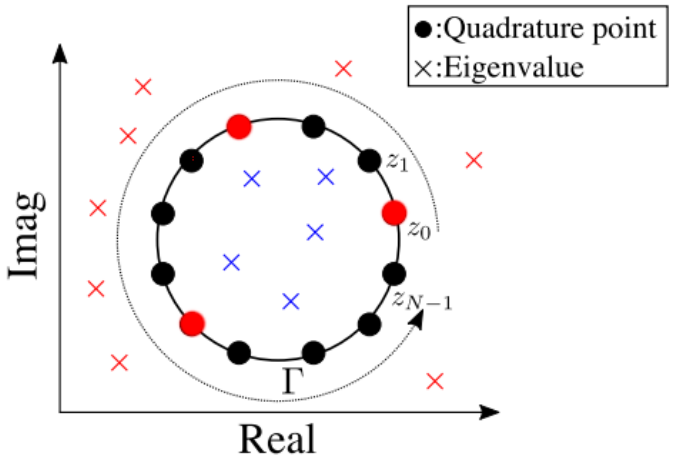

Figure 2: Quadrature points selected using **greedy** strategy.

5 Inhouse FAST CISS

- Experiment 1
  - *tol* = 1e-3
  - integration points: $nc = 40$ (6 selected)
  - size of left/right probing space (random vectors): 11
  - number of moments: 2
  - computational time: 149.5s

l	$\|\|\mathbf{T}(k)\cdot\mathbf{x}\|\|/\|k\|$	f[GHz]
1	1e-7	8.190395985733 + 0.052963320476i
2	1e-4	11.890411954851 + 0.061534636665i
3	1e-4	13.962148177605 + 0.071401755223i
4	8e-6	15.483000966365 + 0.093268341009i

- Experiment 2
  - *tol* = 1e-5
  - integration points: $nc = 40$ (8 selected)
  - size of left/right probing space (random vectors): 11
  - number of moments: 2
  - computational time: 199.0s

l	$\|\|\mathbf{T}(k)\cdot\mathbf{x}\|\|/\|k\|$	f[GHz]
1	5e-9	8.190395960958 + 0.052963326100i
2	8e-7	11.890412081838 + 0.061543088264i
3	1e-7	13.962144598733 + 0.071396540616i
4	1e-8	15.483001264137 + 0.093268183216i