EDISON

Electromagnetic Design of
flexIble SensOrs

FNP Team-Tech

Raport 85 - Different Eigenproblems

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1 Lossy dielectric - example 1

- Project `simple_waveguide_eigs_lossy_dielectric_14_02.ispr` is in the path `C:\FEMCPP 2_Loren_EIGENPROBLEMS\x 64\Release`
- Dielectric: rel. permittivity: 4, tang. delta: 0.01
- The FEM system matrix are obtained running the program with `system(... -s)` flag.
- In `D:\0_badania\2019_12_16_polyeigenproblems\2020_02_15_Lossy_problem_eigs` I run the `eigs` procedure to compute the above eigenvales.
- The computed resonant frequencies (using `eigs`):
  1. 1.0e+10 · (0.825011132444885 + 0.000023301129698i) Hz
  2. 1.0e+10 · (0.825011371830447 + 0.000011523159897i) Hz
  3. 1.0e+10 · (1.152559910788440 + 0.000570866754133i) Hz
  4. 1.0e+10 · (0.675511739592976 + 0.000138276572811i) Hz
  5. 1.0e+10 · (1.366810608870905 + 0.000041474156968i) Hz
- The computed eigenvalues (using `eigs`):
  1. 1.0e+4 · (2.989772896071981 + 0.000083517954591i)
  2. 1.0e+4 · (5.835058888899233 + 0.005780249536862i)
  3. 1.0e+4 · (2.004398709957662 + 0.000820596829125i)
  4. 1.0e+4 · (8.206066130882350 + 0.000498005609419i)
  5. 1.0e+4 · (8.673496478590131 + 0.000198391992504i)
- The computed eigenvalues (using `ARPACK` + `MKL_PARDISO`) using the driver in the folder `C:\FEMCPP2_Loren_EIGENPROBLEMS\x64\Release\driver_rgm_mor_simmulations.m`. To run the project: `simmulate( "simple_waveguide_eigs_lossy_dielectric_14_02",0,1,2,10,3,nam_of_rep2)`. The obtained eigenvalues:
  1. 1.0e+4 · (2.989772896072081 + 0.000083517954595i)
  2. 1.0e+4 · (5.835058888899248 + 0.005780249536855i)
  3. 1.0e+4 · (2.004398709957699 + 0.000820596829126i)
  4. 1.0e+4 · (8.206066130882371 + 0.000498005609423i)

2 Lossy dielectric - example 2 - from Małgorzata Warecka Rep - ARPACK

- geometry of the structure:

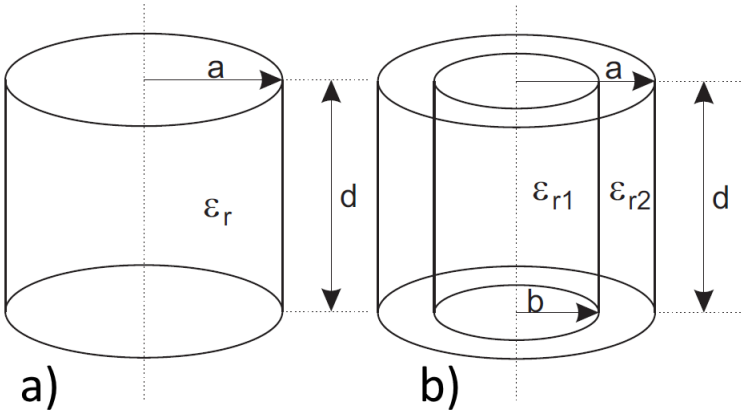

Figure 1: d = $10\sqrt{2}$mm, a = 10mm, b = 6.35mm.

Table 1: A resonance frequency of the homogeneous resonator as a function of the loss coefficient.

ϵ''	1	5
TM_{010}	3.614968939 + 0.180298821i	3.339803162 + 0.788420577i
TE_{111}	4.337174043 + 0.216319249i	4.007035144 + 0.945932682i
TM_{011}	4.921274929 + 0.245451643i	4.546675185 + 1.073324415i
TE_{211}	5.677131457 + 0.283150457i	5.244997097 + 1.238175856i
TM_{110}	5.759876437 + 0.287277414i	5.321443659 + 1.256222442i
TM_{111}	6.657861749 + 0.332064990i	6.151075735 + 1.452072008i
TE_{011}	6.657861749 + 0.332064990i	6.151075735 + 1.452072008i
TE_{311}	7.143795708 + 0.356301248i	6.600021162 + 1.558053647i
TE_{112}	7.229378824 + 0.360569759i	6.679089825 + 1.576719226i
TM_{012}	7.594194258 + 0.378765155i	7.016136079 + 1.656285054i
TM_{210}	7.719942531 + 0.385036928i	7.132312590 + 1.683710608i
TE_{212}	8.104484011 + 0.404216173i	7.487583374 + 1.767578663i
TM_{020}	8.297862124 + 0.413861027i	7.666241848 + 1.809754208i
TM_{211}	8.411210328 + 0.419514339i	7.770962165 + 1.834475321i
TE_{411}	8.662896020 + 0.432067319i	8.003489935 + 1.889367682i
TE_{121}	8.682165324 + 0.433028388i	8.021292490 + 1.893570295i
TE_{012}	8.825400373 + 0.440172325i	8.153624712 + 1.924809695i
TM_{112}	8.819294902 + 0.439867811i	8.147983980 + 1.923478098i
TM_{021}	8.944577258 + 0.446116346i	8.263730039 + 1.950802036i
TM_{310}	9.590752646 + 0.478344745i	8.860719567 + 2.091732147i

- Tab. 1: Reference values of the a) resonantor. We assume $\epsilon_r = \epsilon' - j\epsilon'' = 10 - j1$.
- Define geometry in inventSim (`C:\FEMCPP2_Loren_EIGENPROBLEMS\x64\Release`)
- Run *.brep file in netgen (the one used in `C:\Program Files\InventSim 2.0\netgen\bin`). Firstly, app the appropriate env variable associated with Netgen.
- Check the surfaces, which one is associated with the ports. Next, set these surfaces into PEC in the *.surf file (...0 1).
- Run the project `C:\FEMCPP2_Loren_EIGENPROBLEMS\x64\Release\driver_rgm_mor_simmulations.m` using `simmulate( "Malgorzata_eigs_lossy_dielectric_FULL_21_02", 0, 1, 2, 10, 3, nam_of_rep2)`
- Fig.1: Eigenvalues from Rep and computed using Arpack, with $\sigma = 6$ GHz.

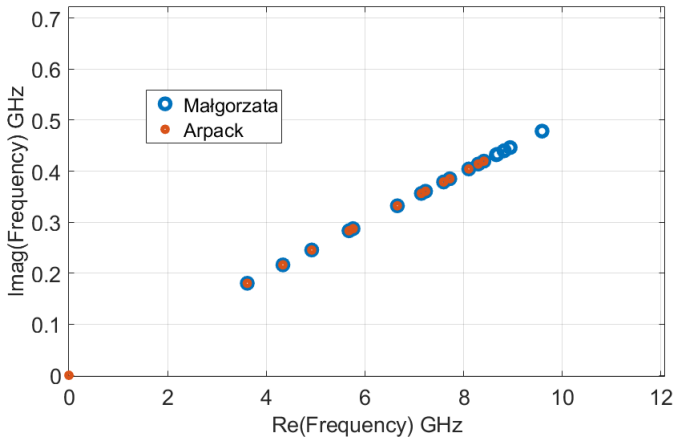

Figure 2: $\sigma = 6$ GHz

3 Lossy dielectric - example 3 - from Małgorzata Warecka Rep - SLEPC

- Smaller project is taken into account: `simple_waveguide_eigs_lossy_dielectric_14_02` - from Section I.
- Fig.2: Eigenvalues from Rep and computed using Arpack and SLEPC with $\sigma = 6$ GHz.

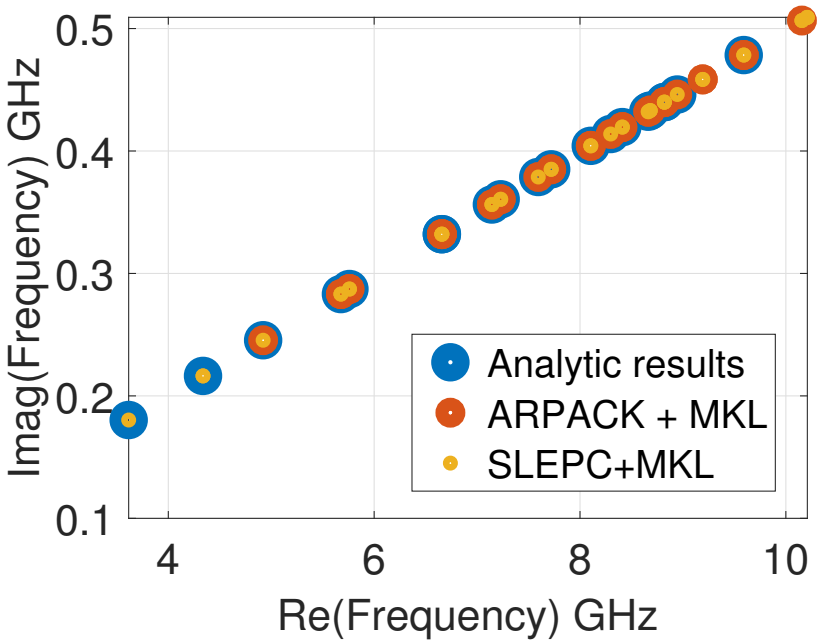

Figure 3: $\sigma = 6$ GHz