Cavity benchmark case

Magnus Gustavsson

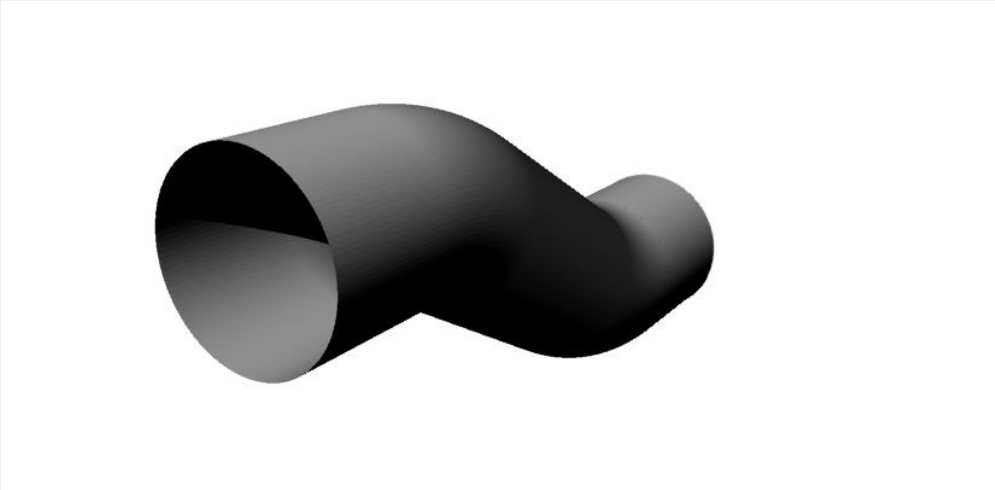
FOI, Div. C4ISR

magnus.gustafsson@foi.se

Niklas Wellander

niklas.wellander@foi.se

Geometry



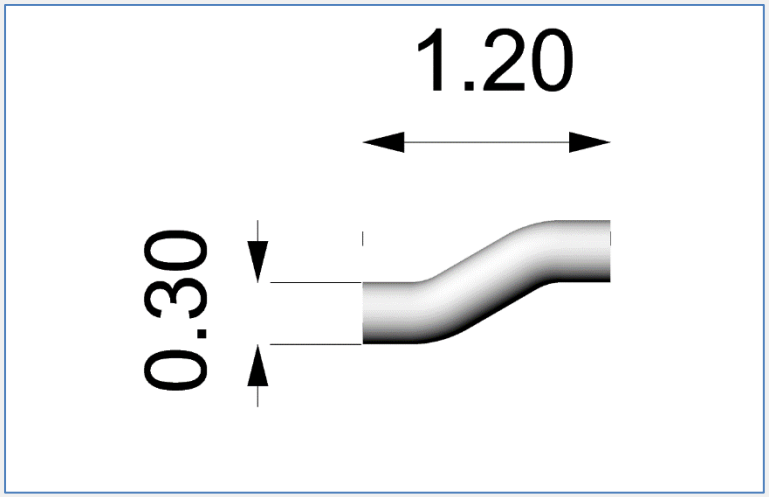
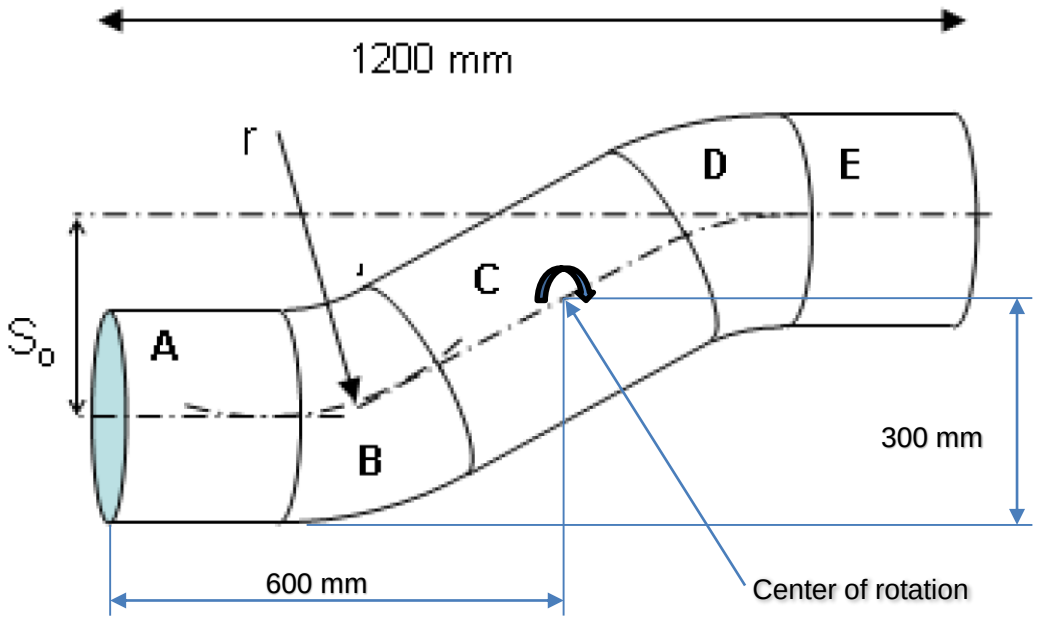


Fig. 1

- Cad files exists in .3dm (Rhino) and .raw-format (raw triangles).
- Closed bottom
- There are two versions
  - one with single sided facets
  - one with an inside and an outside

Geometry



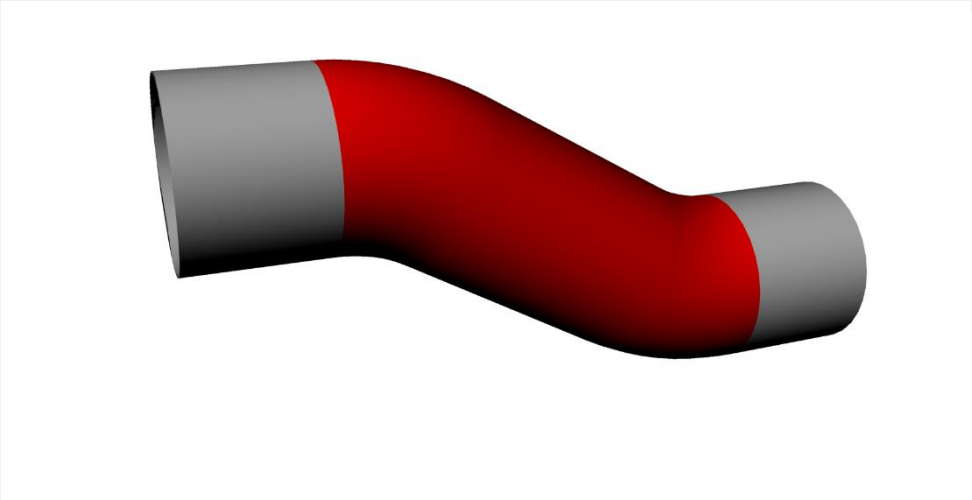
A) Straight section S_1= 232 mm
B) Bend 30 °
C) Straight section S_2= 384 mm
D) Bend 30 °
E) Straight section S_3= 232 mm

Bend radius r = 400 mm
Offset S_o = 300 mm
Di = 300 mm
Dy = 304 mm

Fig. 2

Inner diameter = 300 mm
Outer diameter = 304 mm

Cavity with RAM



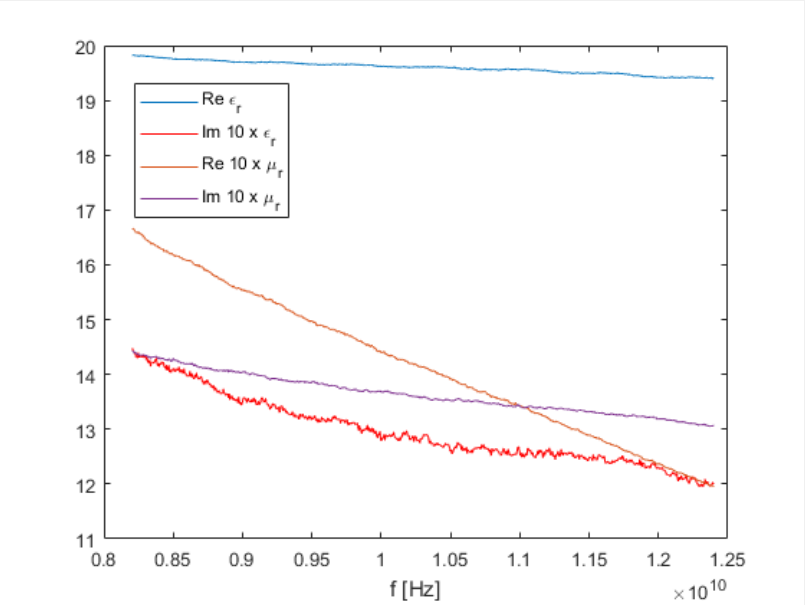


Fig. 3

Red sections (B, C, D) are covered with RAM - FGM 40

Validation

FOI has measurements of the PEC case

- Frequencies: 8-12 GHz
- Horizontal plane, 0-360°
- Polarization: HH- and VV-pol

Case (a): PEC monostatic RCS

- Frequency: 8-12 GHz, Δf = 16 MHz (251 frequency points)
- Angular sweep:

  (a1): θ=90°, φ = [0° - 90°], $\Delta\varphi$ = 0.2° in the horizontal plane where φ = 0° is straight into the cavity

  (a2): φ=0°, θ = [0° - 90°], $\Delta\theta$ = 0.2° in the vertical plane
- Polarizations: Both co-polar, HH and VV

Case (b): Cavity partially covered with RAM monostatic RCS

- RAM FGM 40, thickness = 1 mm, as specified in figure 2.
- Frequency: 8-12 GHz, Δf = 16 MHz (251 frequency points)
- Angular sweep:

  (b1): θ=90°, φ = [0° - 90°], $\Delta\varphi$ = 0.2° in the horizontal plane where φ = 0° is straight into the cavity

  (b2): φ=0°, θ = [0° - 90°], $\Delta\theta$ = 0.2° in the vertical plane
- Polarizations: Both co-polar, HH and VV

Data format

The results will be stored in ASCII files, labeled as:

- test_case_a1_CONTRIBUTOR_NAME.txt
- test_case_a2_CONTRIBUTOR_NAME.txt
- test_case_b1_CONTRIBUTOR_NAME.txt
- test_case_b2_CONTRIBUTOR_NAME.txt

where ”CONTRIBUTOR_NAME” should be relpaced by the name of the contributing institution.

Each file will contain on each row the data (6 columns):

f	φ (or θ)	$Re\,(\sqrt{\sigma\_VV})$	$Im\,(\sqrt{\sigma\_VV})$	$Re\,(\sqrt{\sigma\_HH})$	$Im\,(\sqrt{\sigma\_HH})$

where *f* is the frequency, ϕ (θ) is the angle used in case a1 and b1 (a2 and b2) are the angles in degrees, $\sqrt{\sigma\_VV}$ and $\sqrt{\sigma\_HH}$ are the comlex co-polar normalized far fields in VV- and HH-polaization, respectively, (as defined in Knott et. al. ”Radar Cross Section”, Scitech publishing, Inc.) and *Re* (.) and *Im* (.) denote the real and imaginary parts.

The RCS in dBsm will be calculated by the chairs from this raw data as 20*log10(abs($\sqrt{\sigma\_xx}$)), with $\sqrt{\sigma\_xx}$ = *Re* ($\sqrt{\sigma\_xx}$) + j *Im* ($\sqrt{\sigma\_xx}$)

CAD files

- CAD files are provided on request from Magnus Gustavsson magnus.gustafsson@foi.se

cc: niklas.wellander@foi.se