NPL
National Physical Laboratory

UIA 2007 Symposium

Finite Element Modelling of the NPL High Power Reference Vessel

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20 March 2007

Modelling of vessel + transducers

- Dimensions of vessel: cylinder of height=0.330 m; radius= 0.156 m
- Conical region at bottom of sensor of depth 0.035 m
- Fluid is assumed to be at rest apart from oscillations due to small amplitude acoustic vibrations.
- Viscosity effects are ignored
- Walls of vessel are modelled as rigid boundaries
- Symmetry is exploited
- Frequency of analysis: 25 kHz
- Transducer is of Tonpiltz type configuration
- Use 20-noded piezoelectric brick elements for PZT
- Use 15-node triangular acoustic prism elements for fluid
- Use 20 and 15-noded isoparametric brick and prism elements for 3-D stress analysis
- 1 V excitation across electrodes

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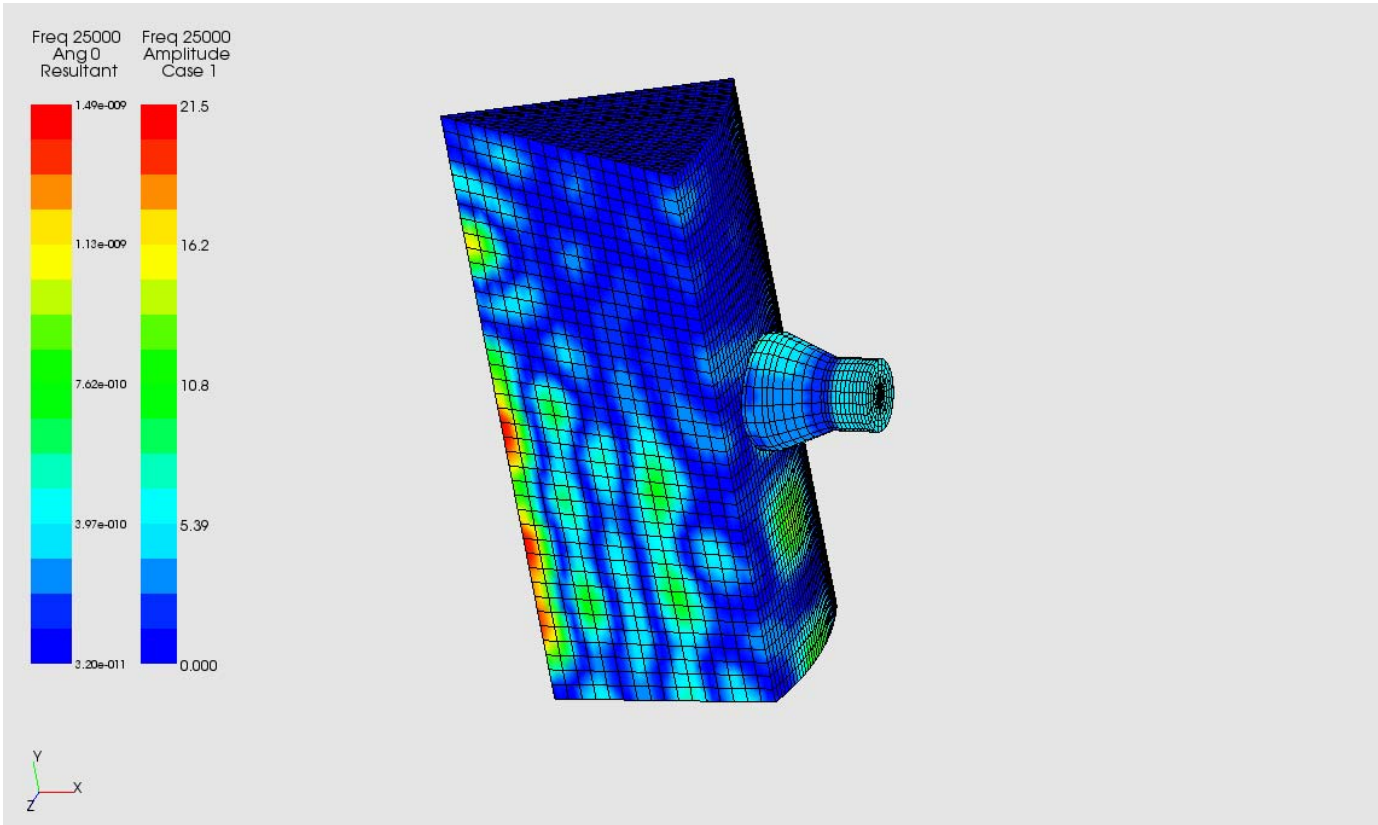
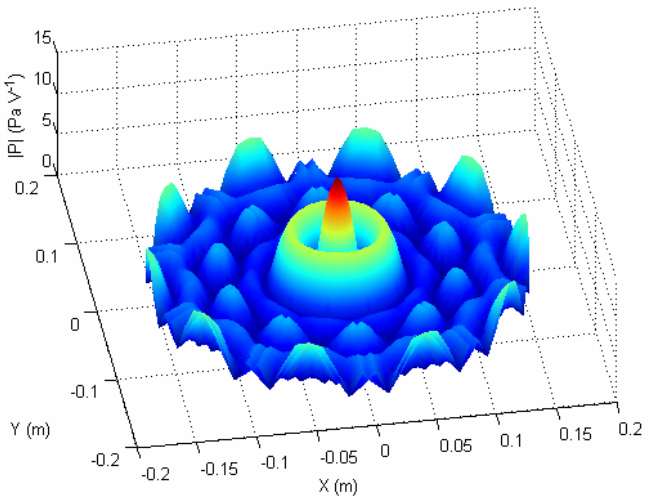
FE model of vessel with transducer

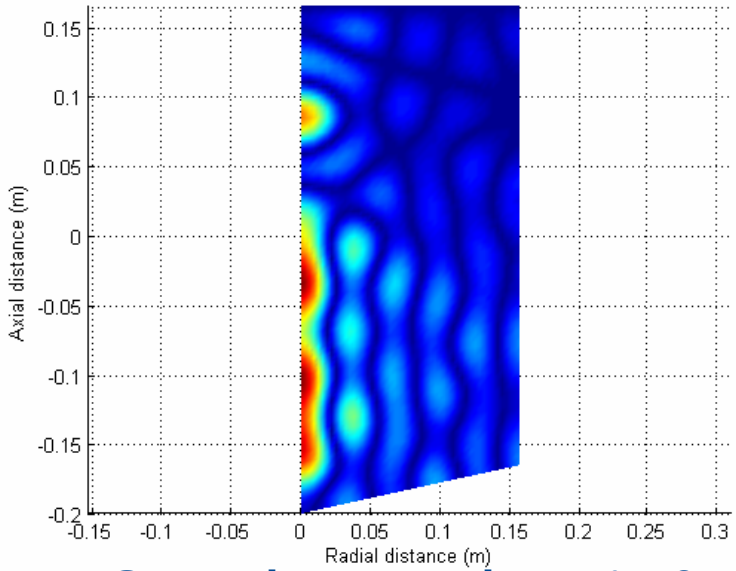


Acoustic pressure mapping

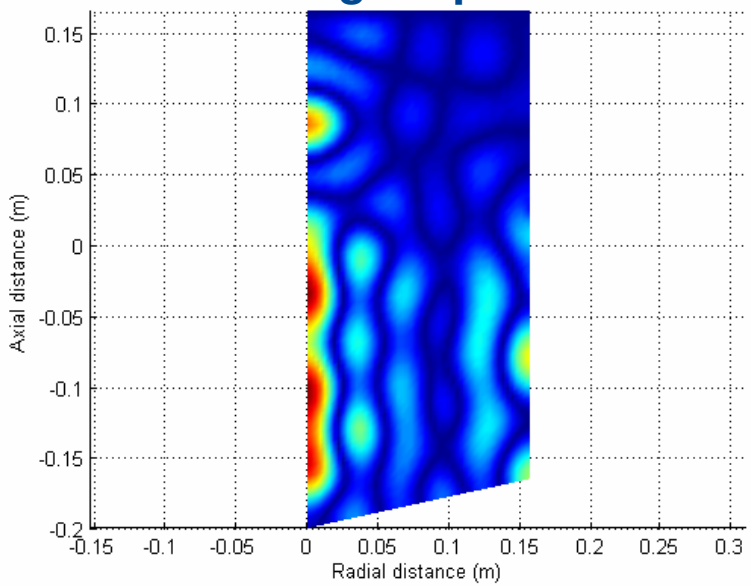


Scan along transducer plane $z = 0$

Scan along r-z plane $\theta = 36°$



Scan along r-z plane $\theta = 0°$



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