A Comparative Study Of Two-dimensional Vocal-tract Acoustic Modeling Based On Finite-Difference Time-Domain Methods

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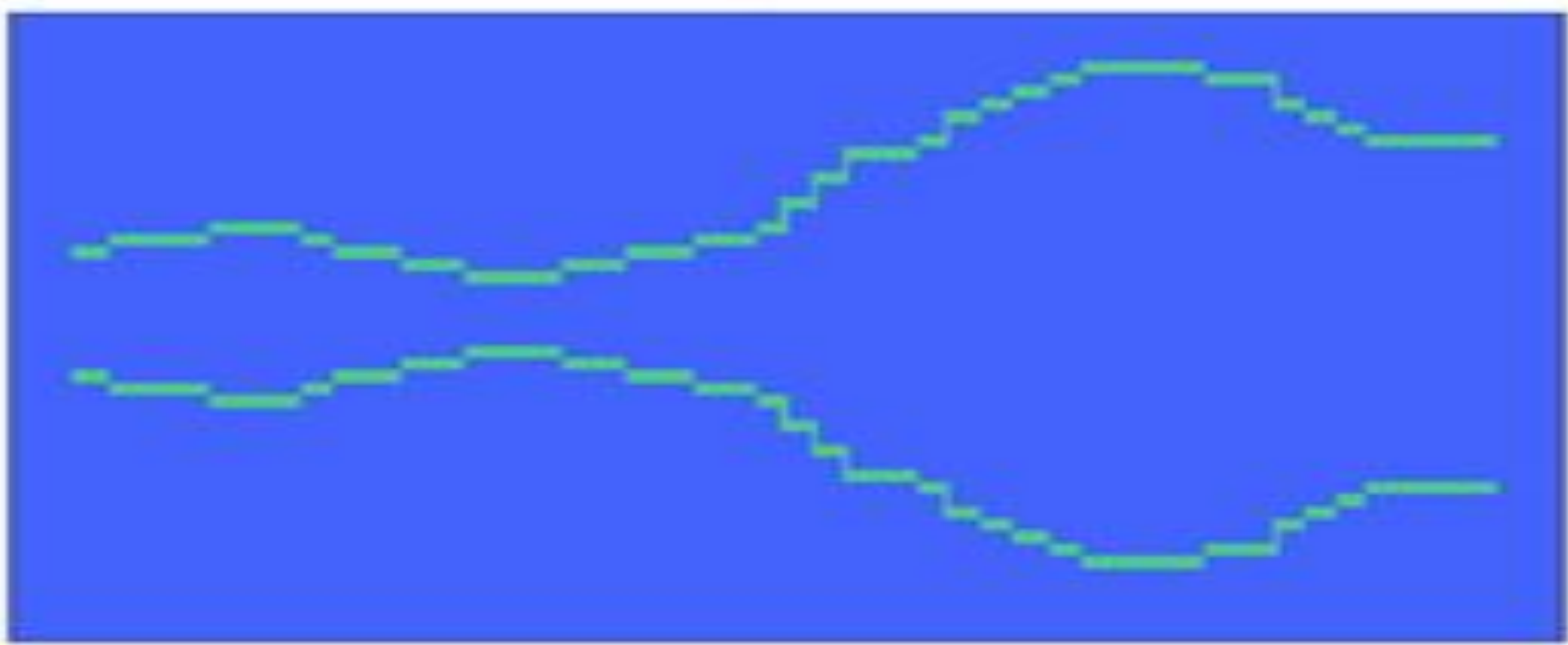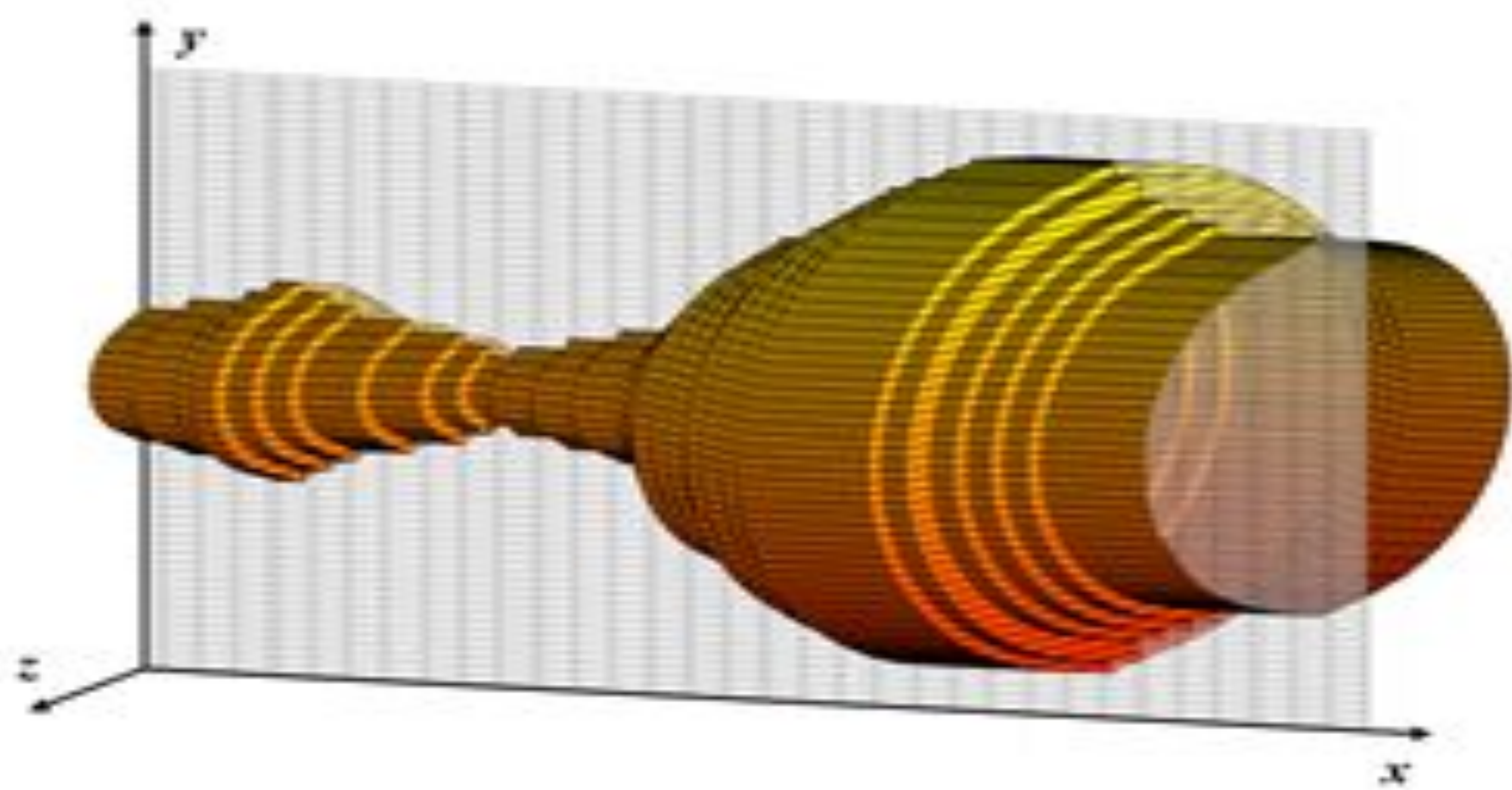
Human Communication Technologies

2.5D FDTD Acoustic Vocal Tract Model

2D VT Model

2.5D VT Model

- 2.5D VT Model improves upon the existing 2D model by including a new impedance parameter to the acoustic wave solver (tube depth).
- The model is capable of lumping wave propagation effects for off-plane waves
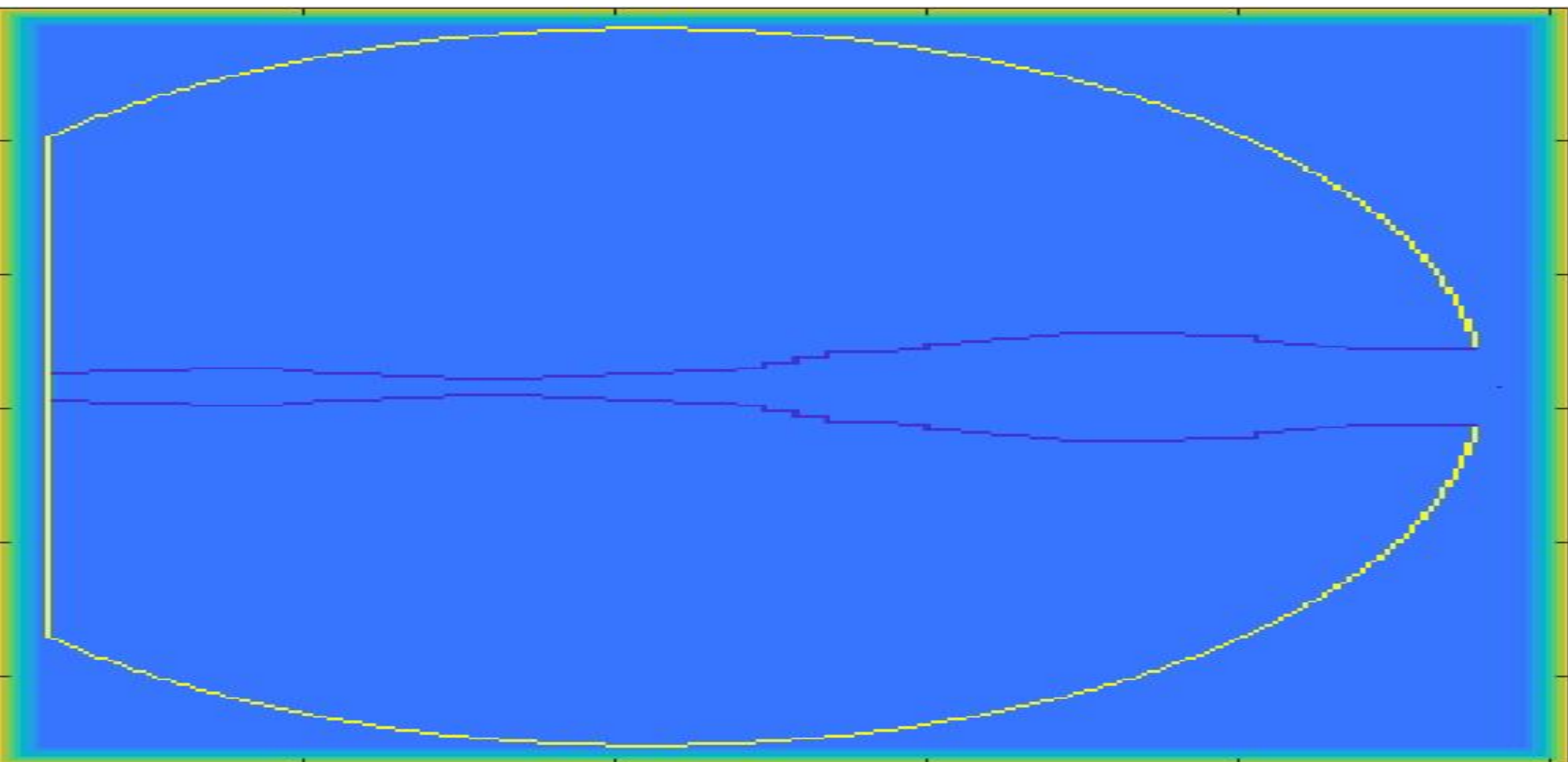
2.5D vs 2D FDTD VT

Model Type	F1	F2	F3
2D FDTD	2.29%	2.62%	1.02%
2.5D FDTD	**0.57%**	2.62%	**0.36%**

Percentage positional error of the first three formants for **vowel /a/**
(Compared with the **3D FEM Model**)

Advantages:

- Provides better **Geometrical Flexibility**
- **Precise Acoustic Simulation** at a lower spatio-temporal resolution

2.5D vs 1D VT (Including Mouth Radiation)

Model Type	F1	F2	F3
2.5D vs 1D	-4.89	8.28	1.76

Percentage deviation of the first three formants for **vowel /a/**

- Included a circular baffle as a head model.