

Airbus A320 Sound Scattering Case Study

Monopole point source excitation | FastBEM Acoustics V9.0 | 89.525 Hz rigid half-space analysis

Boundary elements	Boundary nodes	Field points	Frequency	Iterations	Wall time
539,722	269,865	40,401	89.525 Hz	186	330.24 s

Study method and numerical setup

Objective: Compute scattering of a monopole wave by a sound-hard aircraft above rigid ground, resolving the total and scattered acoustic fields.

Key steps:

1. Use the ANSYS-derived aircraft surface model. Length $\times$ span $\times$ height: 125.303 ft $\times$ 111.789 ft $\times$ 36.142 ft.
2. Use 539,722 triangular elements and 269,865 nodes. Median edge: 0.1976 ft.
3. Place the aircraft above the rigid $y = 0$ ft ground plane; surface elevations range from 44.858 ft to 81.000 ft.
4. Set normal velocity to 0 ft/s on all 539,722 elements. Apply one unit-strength monopole at $(x, y, z) = (200, 0, 200)$ ft, the lower field corner.
5. A 400 ft $\times$ 400 ft ground-plane area (field surface) at 2 ft spacing: 40,401 points and 80,000 triangular field cells.
6. Solve the conventional boundary integral equation at 89.525 Hz: $k \approx 0.5 \text{ ft}^{-1}$, wavelength 12.566 ft, about 64 median edges per wavelength.

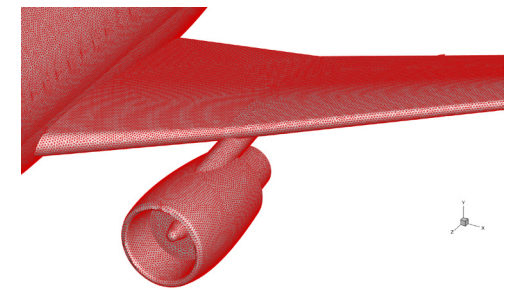
FastBEM setup:

The medium: $c = 1125 \text{ ft/s}$; density = 0.074887 lbm/ft³; reference pressure = 4.18E-7 lbf/ft².
FMM expansion orders $p = 12$ (boundary), 16 (field); 100 elements per leaf; relative tolerance 1.0E-4; Krylov dimension 100; 10 CPU threads.

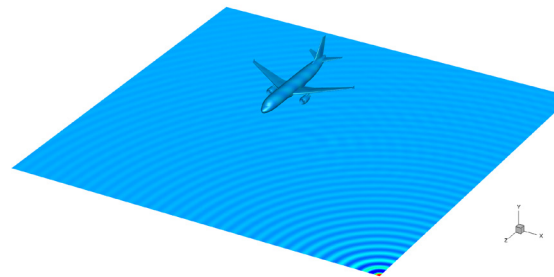
Model and computed response



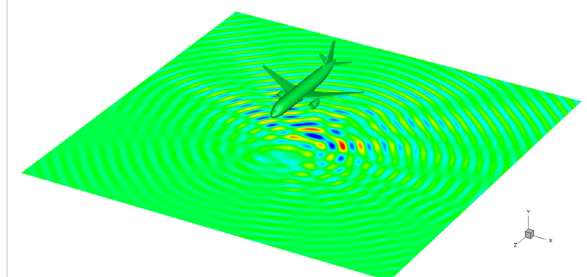
Airbus A320 surface geometry



Wing and engine triangular mesh detail



Total wave on the plane and ground



Scattered wave on the ground plane

Result. The solution converged in 186 iterations to a relative residual of 9.617E-5. Total wall time was 330.24 s (5.50 min), including FMM field evaluation; total CPU time was 3177.48 s. The total field shows wavefronts from the corner source, while the scattered field shows aircraft-induced interference. The source-coincident field point is singular and dominates the reported pressure maximum.