Airbus A320 Sound Radiation Case Study

FastBEM Acoustics®

Aircraft surface radiation | 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	183	343.23 s

Study method and numerical setup

Objective: Compute sound radiation from prescribed aircraft engine vibration above a rigid ground, resolving aircraft surface and ground-plane sound pressure levels.

Key steps:

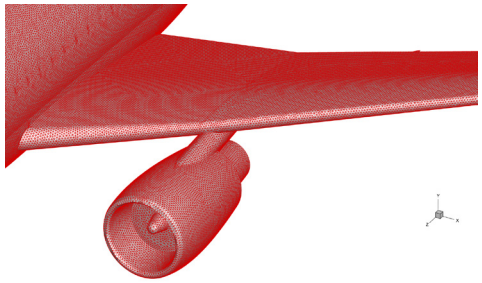
1. Use the ANSYS-derived aircraft surface model. Length × span × height: 125.303 ft × 111.789 ft × 36.142 ft.
2. Use 539,722 triangular elements and 269,865 nodes. Median edge: 0.1976 ft.
3. Place the aircraft above the rigid y = 0 ft ground plane; surface elevations range from 44.858 ft to 81.000 ft.
4. Set normal velocity to (1, 0) ft/s on 65,782 elements and 0 ft/s on 473,940 elements. No incident waves or point sources are applied.
5. A 400 ft × 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 ≈ 0.5 ft^{-1}, wavelength 12.566 ft, about 64 median edges per wavelength.

FastBEM setup:

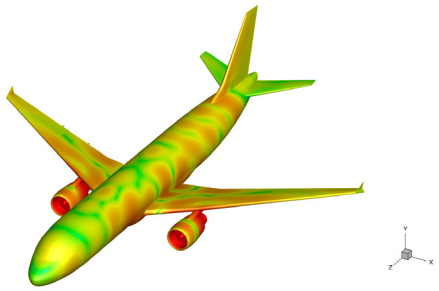
The medium: c = 1125 ft/s; density = 0.074887 lbm/ft^3; reference pressure = 4.18E-7 lbf/ft^2.
FMM expansion orders p = 12 (boundary), 16 (field); 100 elements per leaf; relative tolerance 1.0E-4; Krylov dimension 100; 10 CPU threads.

Model and computed response

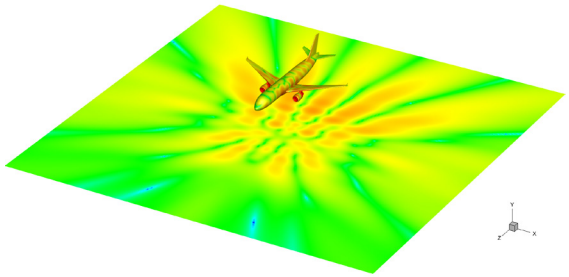
Airbus A320 surface geometry



Wing and engine triangular mesh detail



Computed surface sound pressure level



Sound pressure level on the ground plane

Result. The solution converged in 183 iterations to a relative residual of 9.662E-5. Total wall time was 343.23 s (5.72 min), including FMM field evaluation; total CPU time was 3322.61 s. The maximum sampled ground-plane SPL was 167.978 dB relative to the input reference pressure. The contours show surface variation and interference lobes across the ground plane.