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Acoustic radiation from vibrating panels subject to high-frequency broadband excitation

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Radiation from a baffled panel subject to high-frequency broadband excitation is studied. If the panel flexural waves are subsonic, the radiation comes from edges. For supersonic waves the entire surface is important. Characterization of the radiation is surprisingly straightforward in the high-frequency broadband limit, with simple analytical expressions for directivity patterns. For subsonic waves, a series expansion of the surface velocity wavenumber transform, convergent in the radiating region, can be re- interpreted physically as singularity functions along the panel perimeter, namely the delta function and its derivatives. This interpretation leads to monopole, dipole, and higher-order edge radiators with relative strengths that depend on surface-wave Mach number. Both propagating and evanescent structural waves contribute to the radiation. A proper physical explanation of the radiation is provided both in physical space and transform space. The common interpretation of edge radiation in terms of uncancelled volumetric sources is not correct; the higher order edge singularities are very significant. For low structural damping, this approach leads to a very simple way to calculate the radiated field. The relationship between radiation and structural power flow is potentially useful in energy-intensity based prediction methods with application to vehicle interior noise. (Sponsor NSF)