



Surface Waves on Stealth Aircraft

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Full title

The Characterization of Surface Waves on Low-Observable Structures

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Highlights



Figure 11 Contributions to the radar cross section of a typical airfoil

Edge scattering contributions arising due to reflections are:

- 1) Diffraction caused by the leading/trailing edges
- 2) Diffraction caused by the root/heel-to-wing joints
- 3) Leading edge/camber curve
- 4) Trailing edge/camber curve and camber-to-heel-to-wing joints
- 5) Trailing edge/camber curve and heel-to-heel-to-wing joints
- 6) Wing ends

Not shown: Diffraction from the root and trailing edges that overlap to the sides

Scattering contributions that result from edge diffraction are:

- 1) Scattering from edge discontinuities of camber
- 2) Scattering from edge discontinuities of camber
- 3) Scattering from edge discontinuities of camber
- 4) Scattering from edge discontinuities of camber
- 5) Scattering from edge discontinuities of camber
- 6) Scattering from edge discontinuities of camber

Not shown: Scattering from edge discontinuities of camber

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- 6) Scattering from edge discontinuities of camber

Not shown: Scattering from edge discontinuities of camber

Contributions 12 to 15 can be incorporated by surface wave propagation theory in the software also shown



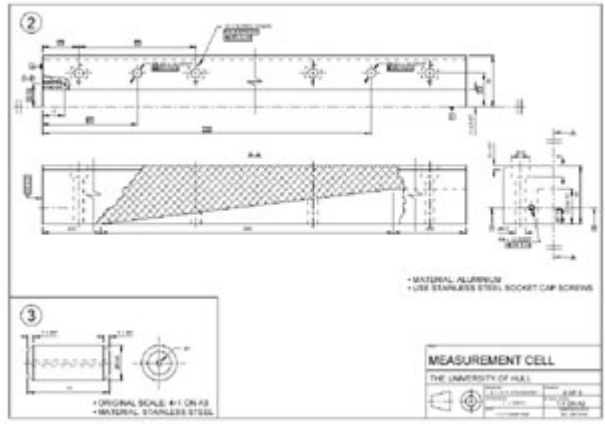
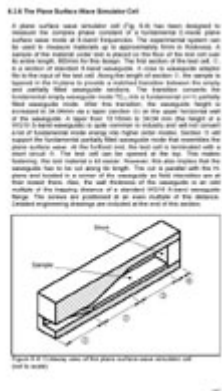
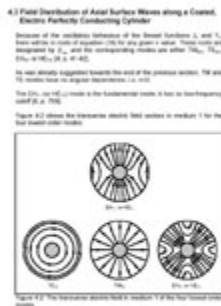
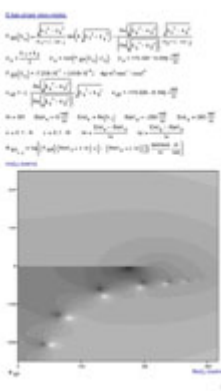
Figure 12 The edge diffraction from the leading edge of a rectangular wing

Edge diffraction can be found at many locations along the leading edge of a planar surface, as is illustrated by Figure 12. It is important to note that it is not always possible to employ the technique used in parabolic ray-tracing theory. This is especially true for the sharp corners where the curved surfaces are for various aircraft being considered in such cases, and this is shown in one of the other radar methods used and discussed in Chapter 4.



Figure 13 The edge diffraction from the leading edge of a curved surface

Edge diffraction can be found at many locations along the leading edge of a curved surface, as is illustrated by Figure 13. It is important to note that it is not always possible to employ the technique used in parabolic ray-tracing theory. This is especially true for the sharp corners where the curved surfaces are for various aircraft being considered in such cases, and this is shown in one of the other radar methods used and discussed in Chapter 4.



Abstract

Edge diffracted waves resulting from the surface discontinuities contribute significantly to the radar cross section of an object. Although this problem could be alleviated by altering the shape of the edge discontinuity, this is not always possible due to other mission requirements.

The backscatter from edge diffracted waves may also be reduced by converting the incoming radar waves into surface waves whose intensity is significantly reduced before reaching the surface discontinuity. This can be achieved by employing isotropic surface wave absorbing materials backed by a metal surface. However, for plane surface waves, the effectiveness of these materials is shown to be strongly polarization dependent.

This work suggests a new strategy which involves replacing the scattering surface by an electromagnetic soft surface. This would result in a complete elimination of the edge diffracted waves in the radar direction, independently of radar polarization.

Furthermore, a new measuring apparatus based on a partially filled rectangular waveguide has been developed for determining the attenuation constant and phase constant of plane surface waves propagating along metal-backed surface wave absorbing materials. Measurements are presented which validate this new measuring method.

Keywords

Radar Cross-Section (RCS) Management, Surface Waves, Radar Absorbing Materials, Electromagnetic Measurements


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Publications

-  S. Y. M. R. Stroobandt and F. C. Smith, "Method for measuring the attenuation and phase constants of a surface wave propagating along an infinite plane," *Electronics Letters*, 33(20):1685–1686, September 1997

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