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Momentum Antennas: Antennas with Semi-Infinite Bandwidth

Although numerous antenna applications demand broad bandwidths, many antenna configurations simply cannot achieve the bandwidths these applications require. For example, both communication and radar systems operate over broad bands of frequency (greater than 2:1 and typically 10:1), yet the electrically or physically limited (compact) antennas available for these applications (e.g. low-profile antennas mounted above conducting metallic platforms as on tanks, aircraft, etc.) often cannot facilitate these needs. Indeed, many existing compact antennas operate as resonant circuits that provide bandwidths of 1.1:1 (10%) or less and therefore require active tuning or multiple resonant antennas to achieve the necessary ranges. When existing broadband antennas (e.g. spiral antennas, log-periodic dipole arrays) are used in these applications they suffer efficiency losses both due to close proximity to conducting materials or as a result of near field power losses effectuated by the absorbing materials required in the antennas? construction.

Researchers at Arizona State University have developed low-profile antennas that have an essentially semi-infinite bandwidth of operation. These Momentum Antennas operate as waveguiding structures with matched radiating discontinuities rather than as resonant circuits and require no tuning. Because the antennas incorporate no absorbing materials the efficiency of the Momentum Antennas is merely a function of the area the antennas occupy on the platform. One design of momentum antennas is particularly suited for broadband applications that simultaneously demand electrically small antennas. The antennas may conform to the surface of their mounting platforms (e.g. civilian vehicles, military vehicles, cell phone frame, etc.) and may operate to both transmit and receive electromagnetic waves.

Potential Applications

- Wireless Communications (e.g. radio, television, point-to-point, LAN, etc.)
- Radar Systems

Benefits and Advantages

- Provides Semi-Infinite Operational Antenna Bandwidth ? Momentum Antennas do not operate as resonant circuits; therefore, the antennas have no reactance and demonstrate a feed having purely resistive load of the order of the radiation resistance; obeys the Fano-Chu efficiency limit corollary for low-frequencies
- Conforms to Its Metallic or Conductive Platform ? delivers low-profile, non-encumbering antennas
- Requires No Absorbing Materials in Construction ? obviates need for tuning

- Offers Efficiency as a Function of the Surface Area the Antenna Occupies