Conformal Antenna Design for Military Vehicle Armor

Ozlem Kilic[(1)] and Steven J. Weiss[(2)]
(1) The Catholic University of America, Washington, DC, 20064
(2) U.S. Army Research Laboratory, Adelphi, MD 20783

The U.S. military is undergoing a major transformation under the Future Combat Systems (FCS) Program in order to be a cost effective, light weight, rapidly deployable and adaptable force. FCS is envisioned as a networked system of systems that is fully operational in ad-hoc network conditions and carries out multiple functionalities such as mobile-networked command, control, communication and computer functionalities, sensor platforms, adverse weather reconnaissance, surveillance, targeting and acquisition. These objectives require military to adapt cutting edge antenna technology on its platforms. While the FCS vision requires the use of sophisticated antennas that can perform multiple functionalities, the military faces challenging requirements to reduce the total weight of its systems in order to be rapidly deployable. These two objectives which can often fall at odds with each other demand trade-offs to be made.

One approach to reduce the weight is to eliminate the heavy armor the vehicles carry. This can be considered only if sufficient protection is provided to the vehicle by other means. The sophisticated antenna system on the vehicle is expected to achieve this by detecting any incoming threats and enabling its deflection or destruction. If this can be done reliably, vehicles can shed off up to 50% of their armor weight. Light-weight armors are being investigated by the military for these purposes.

This work investigates alternative techniques for the design and development of an antenna printed on the new armor. This is expected to reduce the visibility of the antenna. The properties of the armor as a substrate are incorporated in the antenna design. The limitations due to using the armor as a substrate are addressed. One problem is the feeding mechanism of the antenna. The other is the antenna performance on the vehicle platform. Optimal feeding techniques suitable for the vehicle platform and compatible with the armor requirements are developed.