New Developments in IRAs: Shaped Reflectors, Unbalanced Feeds, and Sidelobe Suppression

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We consider here a number of new developments in the theory and practice of Impulse Radiating Antennas (IRAs). These devices, consisting of a paraboloidal reflector and a broadband feed, have demonstrated two decades of bandwidth in a compact package.

First, we have tested a shaped reflector that eliminates the portion of the reflector that contributes destructively to the radiated field. It was predicted by J. S. Tyo that eliminating a portion of the reflector would provide improved gain, and we can report here the first experimental confirmations of that effect. This becomes important in configurations of the IRA where the feed arms are constructed out of a flexible material, and have to be displaced toward the center of the reflector to keep the feed arms under tension.

Next, we have tested the IRA with a simplified feed configuration, using a single 50-ohm feed cable. This contrasts with the splitter balun that is normally used, in order to provide optimal impedance matching. The splitter balun consists of two 100-ohm cables that are connected in parallel at the 50-ohm cable port and in series at the focus of the reflector to feed the 200-ohm feed arms. The unbalanced feed configuration is forced upon us in a number of situations where either the voltage is too high for the splitter balun, or there is insufficient space for it. This may occur, for example, in the Para-IRA. We have found that there is remarkably little deterioration in antenna performance with the simplified feed, especially at the low end of the frequency spectrum.

Finally, we discuss our efforts to build UWB antennas with low sidelobe level, which is an important characteristic for radar applications. This is a considerable challenge in reflector-based IRAs, because of the high aperture fields near the feed arms. To address the problem, we are studying IRAs based on lenses. These have a more uniform aperture field, and initial results appear to be promising.