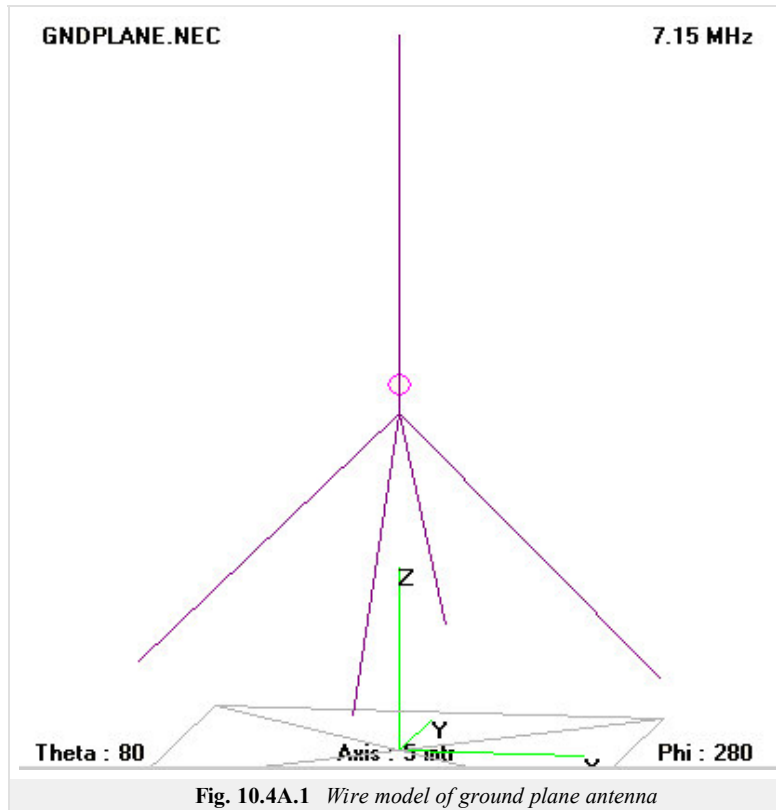


10.4 Quarter wavelength monopole antenna – ground-plane antenna

Basic theory

The quarter wave antenna is a single element antenna fed at one end that behaves as a dipole antenna. It is formed by a conductor in length $\lambda/4$. It is fed in the lower end, which is near a conductive surface which works as a reflector. The current in the reflected image has the same direction and phase that the current in the real antenna. The set quarter-wave plus image forms a half-wave dipole that radiates only in the upper half of space.

In this upper side of space the emitted field has the same amplitude of the field radiated by a half-wave dipole fed with the same current. Therefore, the total emitted power is one-half the emitted power of a half-wave dipole fed with the same current. As the current is the same, the radiation resistance (real part of series impedance) will be one-half of the series impedance of a half-wave dipole. As the reactive part is also divided by 2, the impedance of a quarter wave antenna is $36 + j21 \Omega$. The gain is the same as that for a half-wave dipole ($\lambda/2$) that is 2.14 dBi.



Far from the antenna and near the ground, electromagnetic fields and radiation patterns are the same as for a half-wave dipole. The impedance is not the same as with a good conductor ground plane. Conductivity of earth surface can be improved with an expensive copper wire mesh.

When ground is not available, as in a vehicle, other metallic surfaces can serve a ground plane, for example the roof of the vehicle. In other situations, radial wires placed at the foot of the quarter-wave wire can simulate a ground plane.

