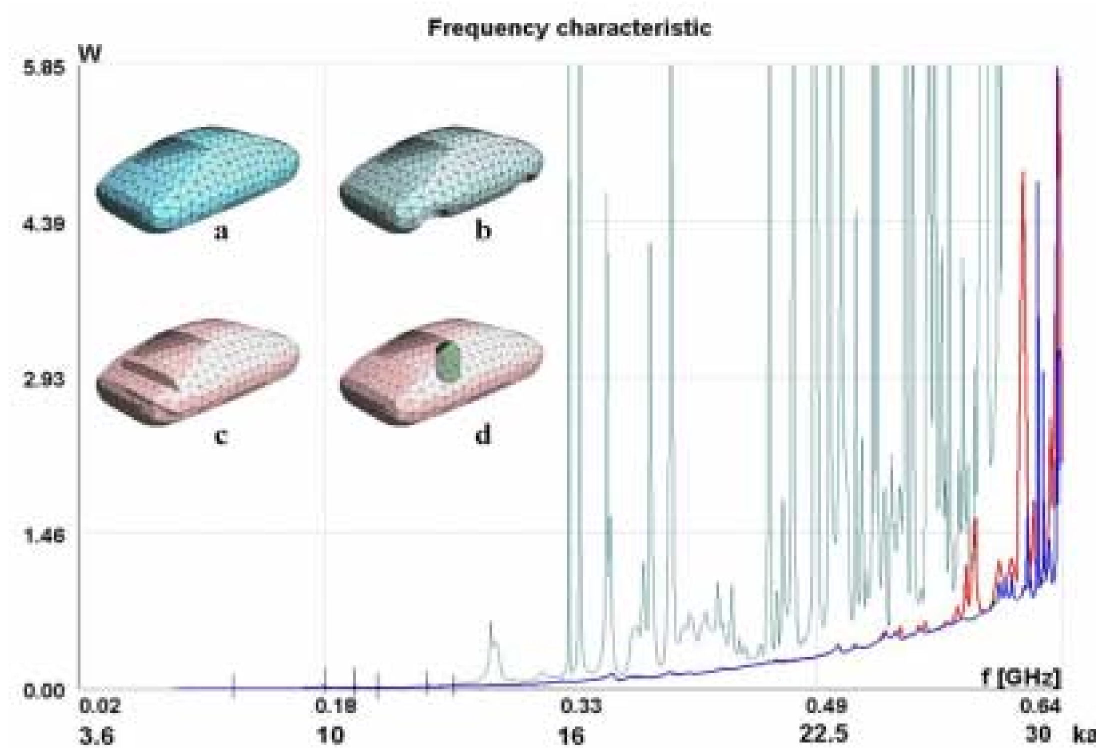
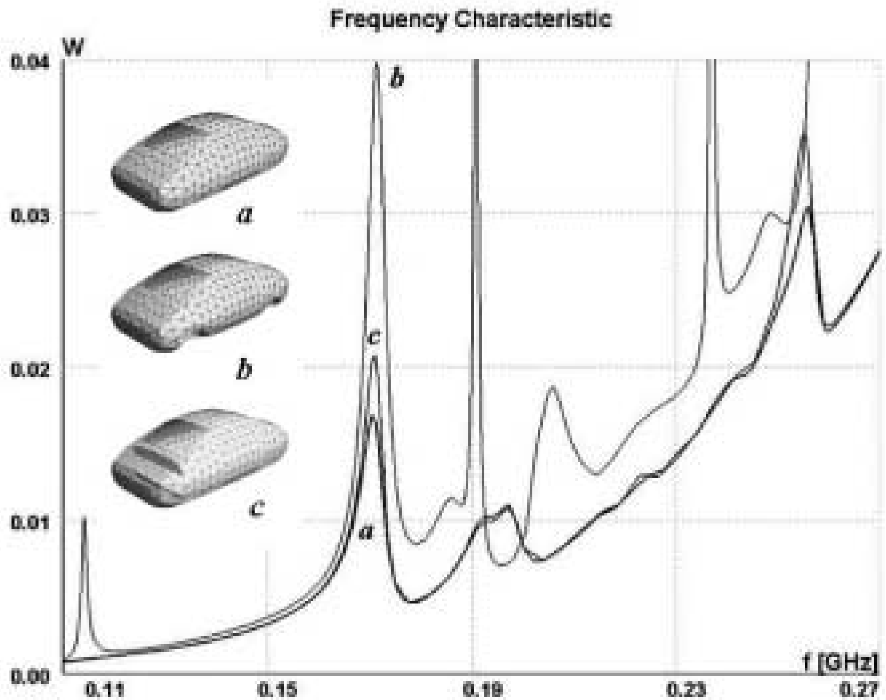
Numerical Calculations

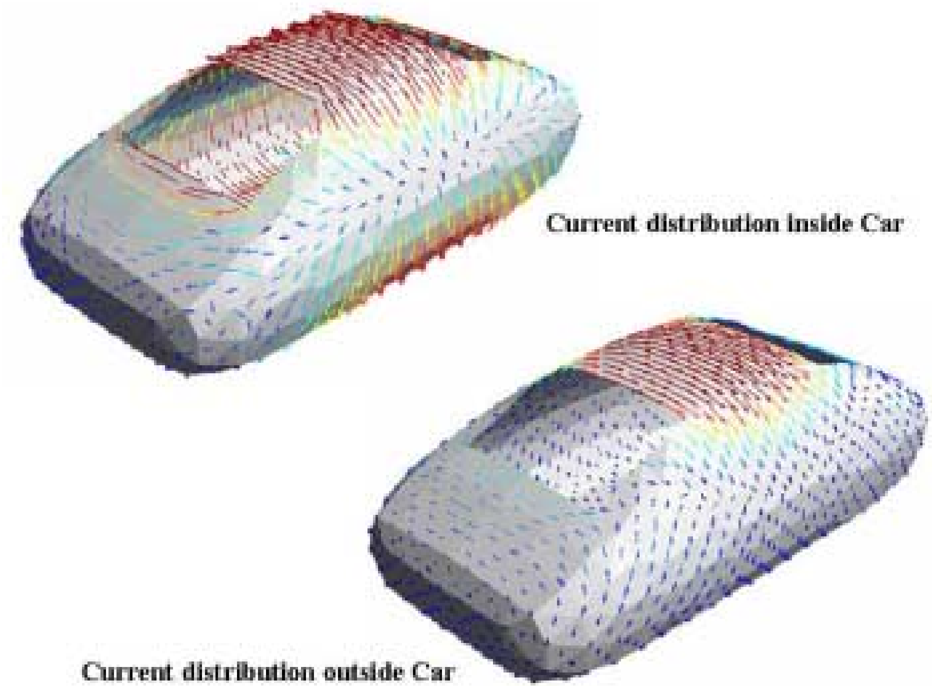
In the first part of this presentation we present some numerical results dealing with the behavior of resonance characteristics for open metallic bodies with a cavity. As examples of geometry we consider 5 different cases using a simplified model of a car body: 1. Empty car body with front and back windows (a). 2. Same main part of the geometry with the addition of wheel wells (b). 3. First geometry with partition, like the engine firewall (c). 4. Empty car body with the addition of lossy dielectric body inside it, resulting in the simulation of a driver (d). 5. Empty car with an addition of a driver, standing outside of the body of the car. The geometric dimensions of the model are 5.0x2.5x1.5m. According to MAS algorithm, the accuracy of the modeling is determined by: 1.choosing the correct functions – Auxiliary Sources in order to represent the scattered field, and 2. correct distribution and determining the best coefficients for boundary conditions satisfaction. The base function chosen satisfy the wave equation by itself.



So, the margin of error of the simulation is determined by how accurately one satisfies the boundary conditions, which could be controlled easily. Throughout this presentation the margin of error in calculated values never exceeds 10%. This simulating software allow for the source of the electromagnetic field to be either inside the car body or outside.

Numerical Calculations

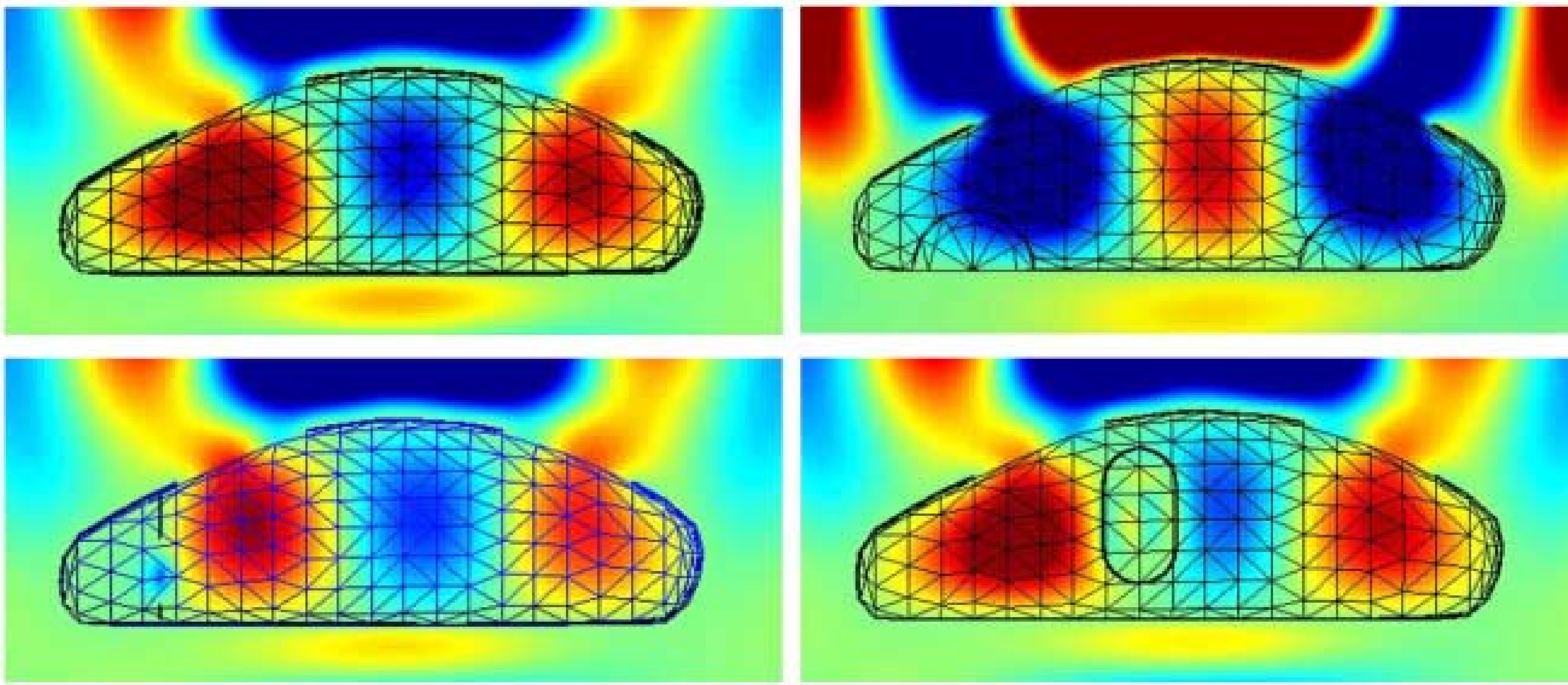




We could point out, that the MAS allow one to calculate more then 30 modes, which have been performed in our case with the same number of unknowns - 2308. One of the main advantages of the MAS is its ability to easily calculate currents, induced both on the car's inner and outer surfaces.

In this figure the induced current distribution on appropriate surfaces on resonance frequency 0.550GHz is given. Detail investigations have shown that current inside the cavity has standing wave nature while that on the outer surface is travelling one. At the same time, strength of the electric field in some points inside the cavity could be much higher then outside in the traveling wave. This phenomenon arises especially on high order resonances when cavity has high Q-factor.

Numerical Calculations

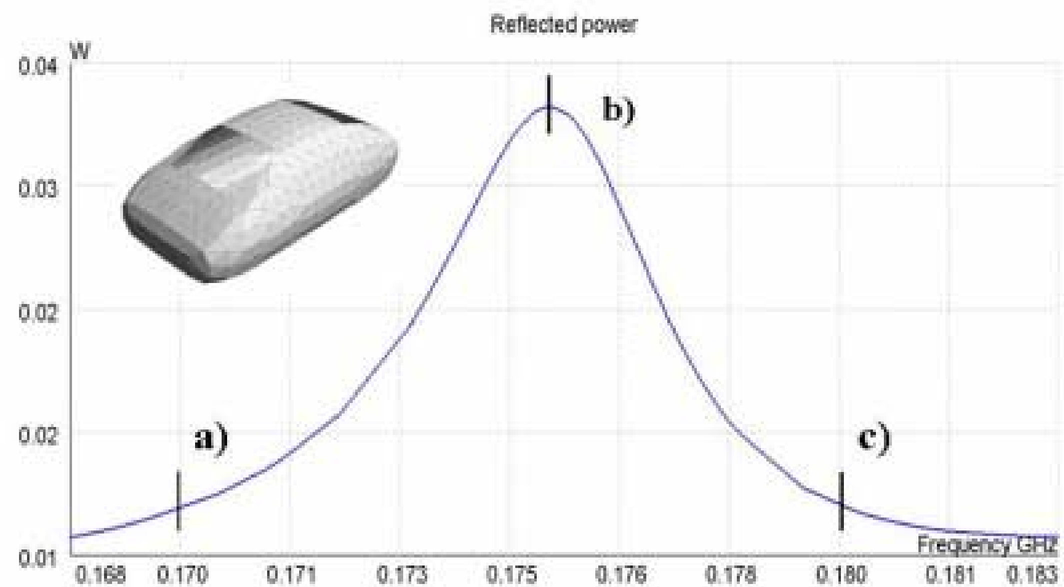


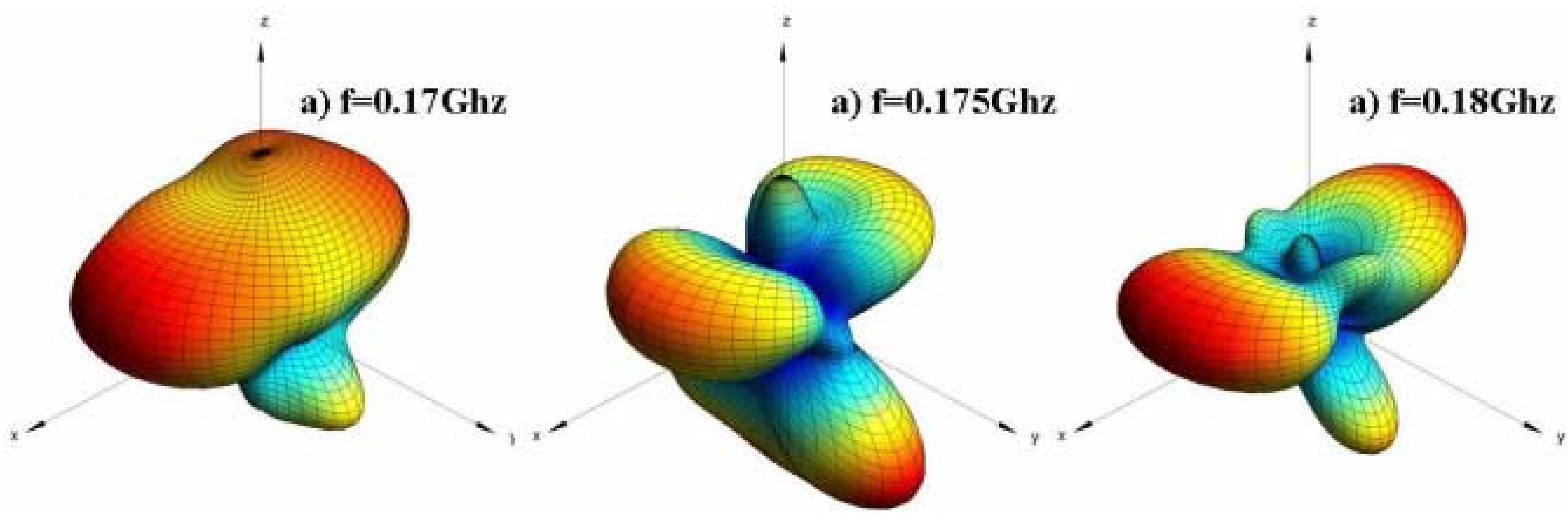
The near field distribution is presented in this picture at the appropriate to the resonance frequency. It was considered also the excitation by the dipole antenna located inside the car. Comparing the result for the both cases of radiated field source placements one can see that the resonance response behavior persists also.

It could point out, that all calculations were done on the regular PC – Pentium III.

Radiated Pattern Near Resonance

We study the EM field properties near resonance. Here shown radiated pattern at resonance, left and right side of the resonance. As we can see the shape of the radiated pattern is different and we can observe the dynamic change of the process near the resonance. At this case the new direction lobe of propagate wave is born.





Car with Wire Inside (ka=20)

Also our program package allow to solve problem when simple wire systems are inserted inside car. For example, in this diagram shown the current amplitude distribution along the wire length when the wire is located in different place. At the bottom pictures shown near field distribution and with white circle marketed wire positions. In fetcher we planed to considered complex wire systems and investigate resonance characteristic such system and current distribution along the wire. This helps to find safe places inside car from EMC point of view.