Cell Phones in Automobiles

During the last years the use of cellular phones has been widely spread. As a consequence, the possible health risks from the electromagnetic energy emitted by the mobile terminals have increased the public concern. Most of these devices operate near the microwaves frequency band, and that they are usually utilized near the human body.

Exposure of human phantom by cell phone in car model is calculated within EMC Studio.

Human Body Phantoms in Car Model

Influence of radiation from cell phone to human phantom (driver) located in the car model is considered.

Two variations of phone location are investigated:

- Human uses phone inside car by handling it near the head
- Human uses cell phone inside car by means of "Bluetooth" wireless technology

Human body phantom is modeled as dielectric object, consisting of two parts: head and body. For the head modeling dielectric parameters are chosen as average values for human brain, for the body modeling – average parameters for human muscles.

Table. 1. Human head and body parameters

Parameter	Head	Body
Dielectric permittivity	50	55.9
Conductivity [S/m]	1	0.97
Mass density [kg/m3]	1000	1050

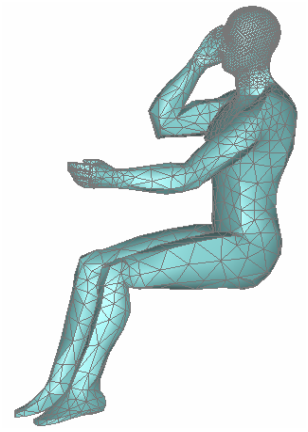

Fig. 1. Human phantom using cell phone by handling it near head

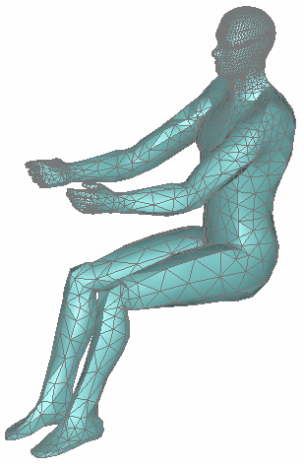

Fig. 2. Human phantom using cell phone via Bluetooth interface

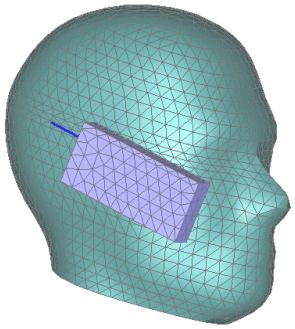

Fig. 3. Cell phone location relative to head model

For investigations human phantom is considered sitting in the car model as shown in Fig. 4.

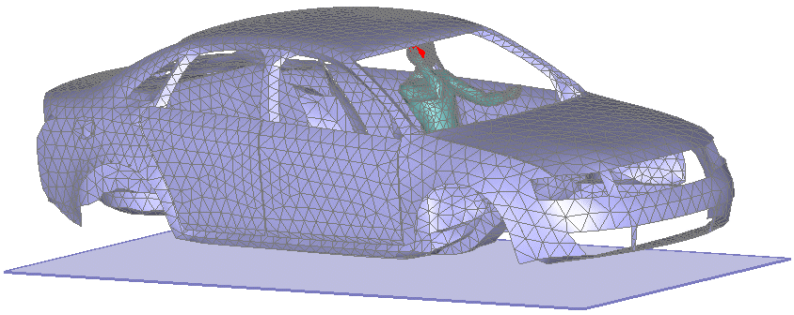

Fig. 4. Human phantom uses cell phone inside car by handling it near the head

Model for the case when cell phone is used inside car by means of Bluetooth interface is shown in the Fig. 5 - Fig. 6. Cell phone model is located in the storage area in the middle of the passenger compartment on the height of the human knees.

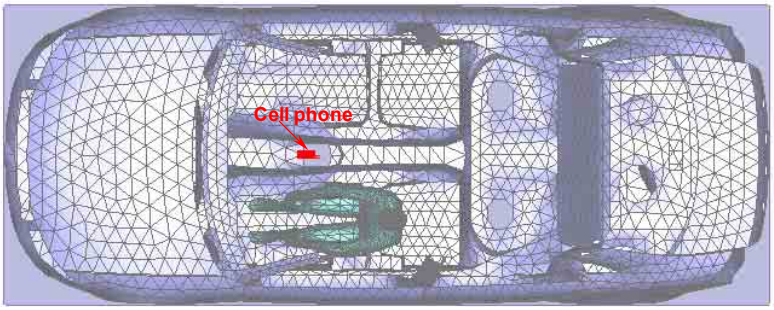

Fig. 5. Human phantom and cell phone inside the car. Top view

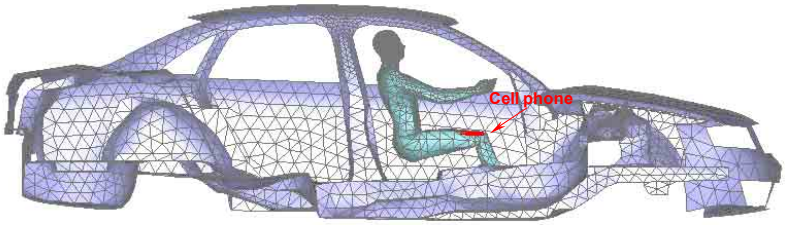

Fig. 6. Human phantom and cell phone inside the car. Side view

Field Distribution around the Human Phantom in the Car

For the investigations cell phone operating at the frequency 900 MHz is considered. During cell phone operation antenna power changes, average value equal to 600 mW is considered as input power of antenna. Cell phone is modeled as a box of realistic dimensions (100 x 16 x 45 mm) with rod antenna. For numerical analysis Surface Integral Approach for modeling of metallic and dielectric bodies is used.

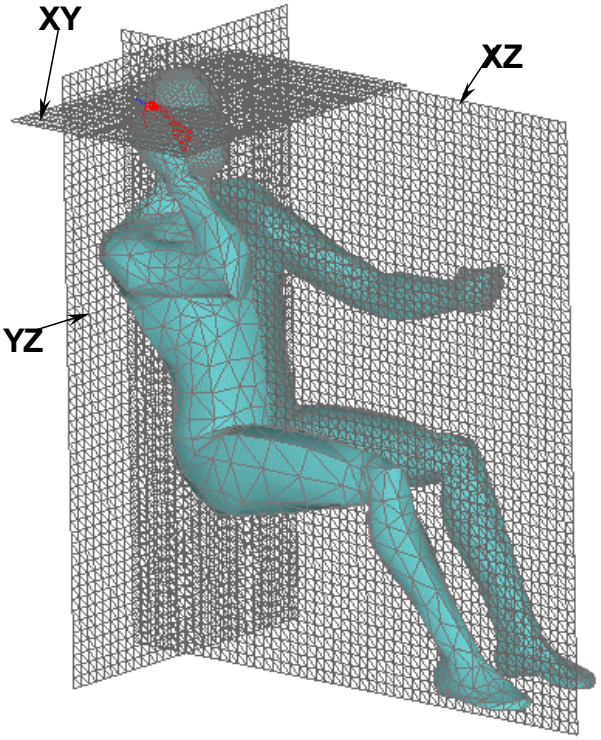

Fig. 7. Cross-sections for the electric field calculations around the sitting human phantom

Electric field distribution around the human phantom sitting in the car and using cell phone is shown in the Fig. 8 - Fig. 13.

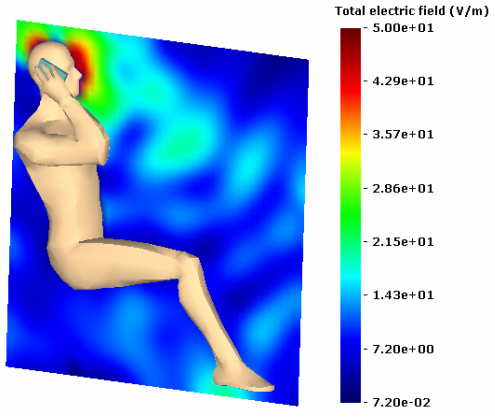

Fig. 8. Human with cell phone near head. Electric field distribution for the XZ cross-section

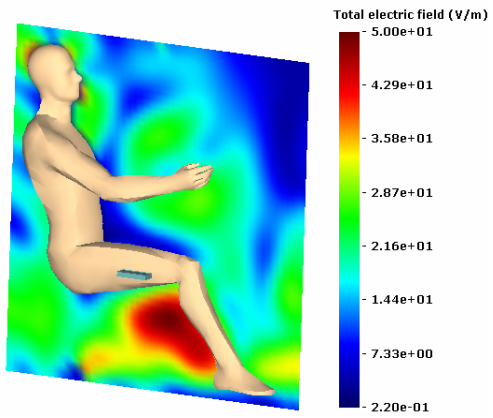

Fig. 9. Human with cell phone in storage area. Electric field distribution for the XZ cross-section

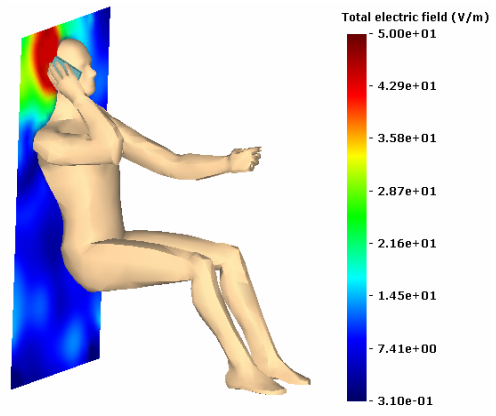

Fig. 10. Human with cell phone near head. Electric field distribution for the YZ cross-section

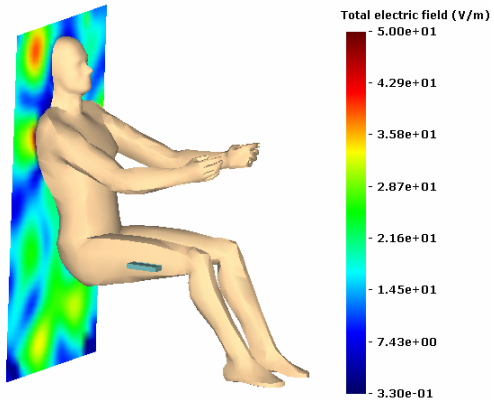

Fig. 11. Human with cell phone in storage area. Electric field distribution for the YZ cross-section

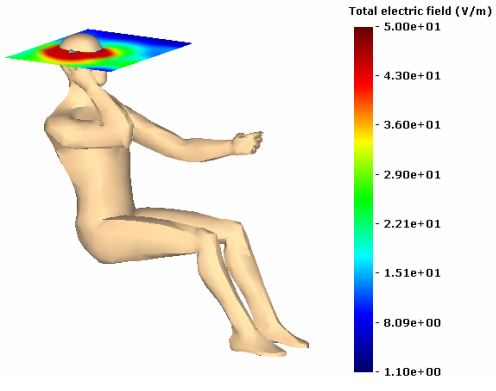

Fig. 12. Human with cell phone near head. Electric field distribution for the XY cross-section

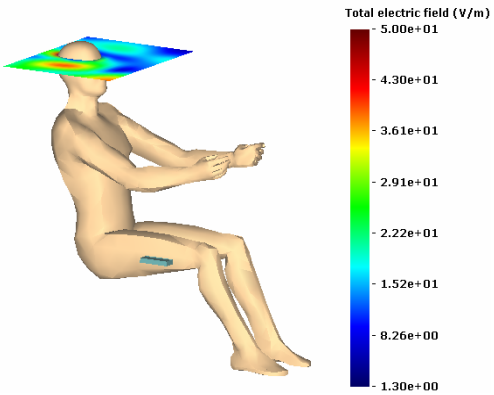

Fig. 13. Human with cell phone in storage area. Electric field distribution for the XY cross-section

Conclusions

- Within EMC Studio simulations of Cell phones in automobiles with presence of human phantom can be performed using Surface Integral Approach
- The EM fields produced by cell phone around human phantom can be calculated

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References

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