



CEM SOLUTIONS IN AUTOMOTIVE

Computational Electromagnetics for smart, safe and connected vehicles

KEY BENEFITS

- Extensive use of hybrid techniques to handle realistic scenarios
- Building fully equipped industrial models in their early design stage: full car body with components, cables, wiring and equipment, antennas, sensors
- Continuously enhanced simulation process to increase resolution speed and ease-of-use
- Dedicated processes for easier cleaning and meshing stages of poor geometrical models
- Very wide frequency spectrum ranging from radio-frequency to millimeter waves
- User-friendly interface hosted on a multi-domain platform shared by thousands of industrial customers worldwide
- Automatic processing and full reports generation based on user-defined templates

INDUSTRIAL APPLICATIONS COVERED IN THE AUTOMOTIVE SECTOR

- Immunity or Susceptibility (EMS) to external electromagnetic aggressions
- Electromagnetic Radiation of onboard electronics and wiring
- Interference between internal components, cross coupling
- Virtual Anechoic Chamber
- Full Radio Noise process
- Performance assessment of RADAR sensors and mm-wave devices
- Antenna and sensors placement

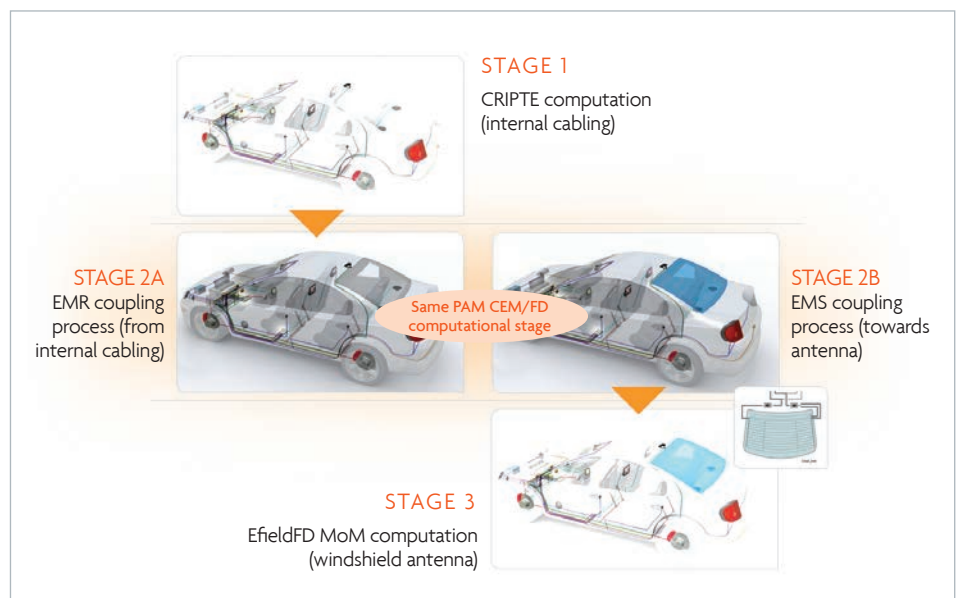
THE NEW CHALLENGE

Cars of the future will be smart and connected, forming a new driving experience, by combining security, comfort and infotainment with global and safe mobility. With sophisticated sensors, hundreds of processors, kilometers of wiring, and onboard electronics reaching up to 40% of the total manufacturing cost, mastering the overall electromagnetic compliance of a fully equipped automotive vehicle has become a key challenge for EMC experts. Shortened development cycles combined with less prototypes make ESI Virtual Prototyping the right solution for a safe and reliable electromagnetic design.

A COMPLETE AND DEDICATED ENVIRONMENT

Within the Visual-CEM environment, fully equipped industrial models can be managed in a complete and dedicated manner. All major frequency and time domain computational techniques are proposed by CEM Solutions for both radiated and conducted phenomena. Method of Moments with Multi-Level Fast Multipole Method (MoM/MLFMM), Multiconductor Transmission Lines (MTL), Physical Optics (PO), Finite Element (FEM) or Finite Difference (FDTD) can be applied by either stand-alone use, coupled, or a hybrid of two, to address key electromagnetic issues early in the development stage of new vehicles:

- Immunity, radiation and overall EMC compliance,
- Monitoring sensors, antenna placement and optimization,
- Radio Noise and other interference issues with internal cabling,
- Performance assessment of RADAR sensors and millimeter-wave devices (short and long range, 24 or 77 GHz).

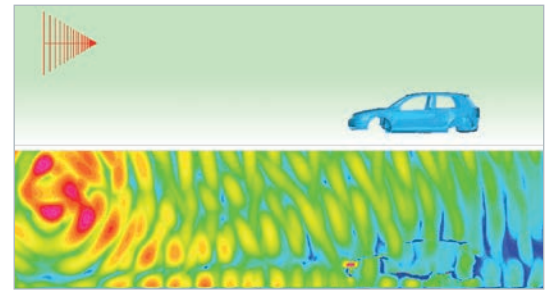


Courtesy: Verizon Telematics

SELECTED AUTOMOTIVE APPLICATIONS WITH CEM SOLUTIONS

Virtual Anechoic Chamber

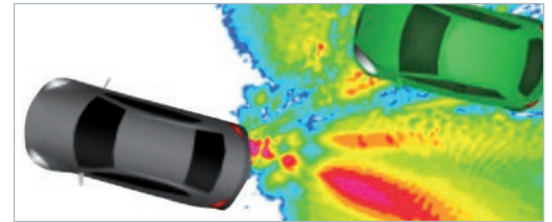
With dedicated 3D/MTL coupling options, Virtual Testing facilities are proposed for EMC Compliance of fully equipped industrial models, reduced Electromagnetic Susceptibility (EMS) and low Emission (EMI).



Virtual Anechoic Chamber

Radio Noise and Electromagnetic Interference

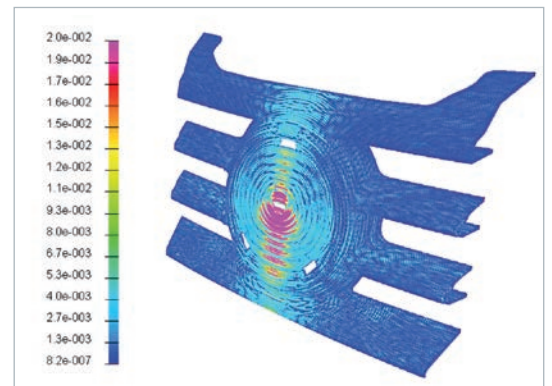
Starting with the 3D/MTL coupling configurations aimed at addressing most EMC compliance scenarios, a dedicated Radio Noise process has been defined to evaluate the unwanted electromagnetic noise created by internal cabling and other emitting components towards onboard components, e.g. back window antennas or Bluetooth receivers.



Short Range Blind Spot Assistance (courtesy MAZDA Motor Corporation)

Advanced Driver Assistance & Blind Spot Detection

With the objective of defining a design leading to optimized electromagnetic performances, 24 GHz RADAR sensors were investigated behind various 3D shaped plastic bumpers covered with very thin metallized paint coatings. A highly multiscale modeling process was developed, combining standard computational techniques (FDTD, PO) with analytical formulations to include the roadway, metallic rail guards and other nearby vehicles in the complete 3D scene. Within this frame, dealing with a fully realistic scenario gathering all major contributors was the key challenge for a 24 GHz operating frequency.



Long Range Detection: 77 GHz sensor radiating behind plastic grille (detail)

Active Safety & Long Range Detection Devices (Anti-Collision)

By tripling the operating frequency, the multiscale coupling strategy applied with Blind Spot assistance can be extended to Long Range detection. Combining Physical Optics with FDTD or MoM/MLFMM, two options are proposed based either on Huygens surfaces surrounding the transmitter or using the Spherical Wave Expansion (SWE) technique, this second method being much faster and easier to handle.

ABOUT ESI GROUP

ESI is a pioneer and world-leading provider in Virtual Prototyping that takes into account the physics of materials. ESI boasts a unique know-how in Virtual Product Engineering, based on an integrated suite of coherent, industry-oriented applications. Addressing manufacturing industries, Virtual Product Engineering aims to replace physical prototypes by realistically simulating a product's behavior during testing, to fine-tune fabrication and assembly processes in accordance with desired product performance, and to evaluate the impact on product use under normal or accidental conditions. ESI's solutions fit into a single collaborative and open environment for End-to-End Virtual Prototyping. These solutions are delivered using the latest technologies, including immersive Virtual Reality, to bring products to life in 3D; helping customers make the right decisions throughout product development. The company employs about 1000 high-level specialists worldwide covering more than 40 countries. ESI Group is a French company listed in compartment C of NYSE Euronext Paris.



EUROPE

SCANDINAVIA

Efeld ESI
Sjöängsvägen 15
SE-192 72
Sollentuna
T. +46 (0)8 410 03 510

CZECH REPUBLIC & EASTERN EUROPE

MECAS ESI
Brojova 2113/16
326 00 Pilsen
Czech Republic
T. +420 377 432 931
F. +420 377 432 930

FRANCE

ESI France
Parc d'Affaires Siliic
99, rue des Solets
BP 80112
94513 Rungis cedex
France
T. +33 (0)1 49 78 28 00
F. +33 (0)1 46 87 72 02

GERMANY

ESI GmbH Hdqt
Siemensstr. 12
63263 Neu-Isenburg
Germany
T. +49 6102 2067 - 0
F. +49 6102 2067 - 111

ITALY

ESI Italia
Viale Angelo Masini, 36
40126 Bologna (BO)
Italy
T. +39 0516335577
T. +39 0516335578
F. +39 0516335601

SPAIN

ESI Group Hispania Hdqt
Parque Empresarial Arroyo de la Vega
C/ Francisca Delgado,
11 - planta 3ª
28108 Alcobendas (Madrid)
Spain
T. +34 91 484 02 56
F. +34 91 484 02 55

SWITZERLAND

Calcom ESI SA
EPFL Innovation Park
Bâtiment A
CH - 1015 Lausanne
Switzerland
T. +41 21 693 2918
F. +41 21 693 4740

UNITED KINGDOM

ESI UK
16 Morston Court,
Kingswood Lakeside,
Cannock, WS11 8JB
United Kingdom
T. +44 (0) 1543397900
F. +44 (0) 1543504898

AMERICAS

USA

ESI North America Hdqt
32605 W 12 Mile Road
Suite 350
Farmington Hills, MI
48334-3379
USA
T. +1 (248) 381-8040
F. +1 (248) 381-8998

USA

ESI North America
6767 Old Madison Pike
Suite 600
Huntsville, AL 35806
USA
T. +1 (256) 713-4700
F. +1 (256) 713-4799

SOUTH AMERICA

ESI South America
Av. Pedroso de Moraes,
1619 cj.312
São Paulo
SP CEP 05419-001
Brazil
T./F. +55 (011) 3031-6221

ASIA

CHINA

ESI China
Unit 1006-1008,
Metropolis Tower
No. 2 Haidiandongsanjie,
Haidian District,
Beijing, 100080
China
T. +86 (10)-65544907/8/9
F. +86 (10)-65544911

INDIA

ESI India Hdqt
No. 24-25, Ground floor
27th Cross Banashankri
2nd stage
Bangalore 560 070
India
T. +91 80 4017 4747
F. +91 80 4017 4705

JAPAN

ESI Japan Hdqt
5F and 16F Shinjuku Green
Tower Bldg. 6-14-1,
Nishi-Shinjuku
Shinjuku-ku, Tokyo 160-0023
Japan
T. +81 3 6381 8490 / 8494
F. +81 3 6381 8488 / 8489

SOUTH KOREA

Hankook ESI
4F Ryuhsan B/D, 134-1
Gayang-dong,
Gangseo-gu
Seoul 157-801
Korea
T. +82 2 3660 4500
F. +82 2 3662 0084

SOUTH-EAST ASIA

ESI Group South-East Asia
ROAP Office
N° 20-2 (2nd floor)
Jalan Metro Pudu
Fraser Business Park
55100 Kuala Lumpur,
Malaysia
T. +603 2857 1572



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