Ansys EMA3D Charge

ELECTRONICS

Ansys EMA3D Charge analyzes charging and discharging phenomena. It uses time domain solvers to simulate electric arcing in air, surface and internal charging, particle transport and dielectric breakdown. It helps you assess and manage risks associated with excessive charge build-up in your system, which can result in material degradation, arcing and electromagnetic interference (EMI) in harsh radiation environments or high voltage systems. You can easily clean your 3D CAD model, assign material properties, define environments, mesh your model, run and analyze simulations all within the Ansys EMA3D Charge user interface, which is embedded in Ansys SpaceClaim.

/ Targeting your top 4 challenges, EMA3D Charge:

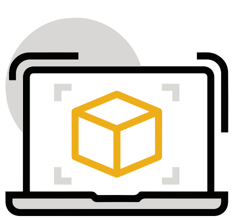
- **Performs accurate charging analysis to determine when, where and how an electric arc problem is created, as the undesirable EMI effects and material degradation are very difficult to anticipate.**
- **Predicts charge accumulation on satellites and space platforms – a complex task that requires adept knowledge of plasma and material physics.**
- **Prevents catastrophic failure of satellites due to discharge events, which must be tackled in the design phase of the project, as testing in space is nearly impossible.**
- **Manages the consequences of electrostatic discharges in air and solid dielectrics, which historically requires numerous and complex simulation tools, with steep learning curves.**

/ Achieving your top 4 tasks:

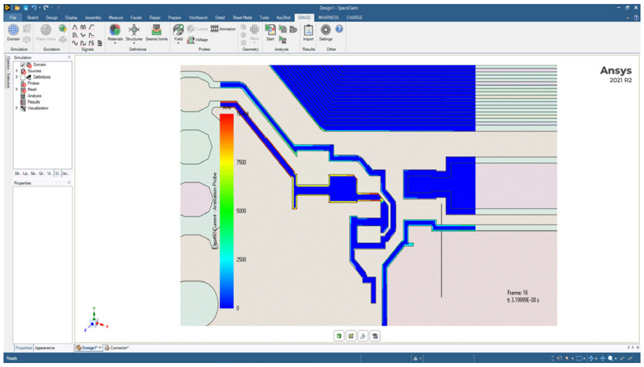
Accurately predict the phenomena of spacecraft charge and avoid irreversible failure by coupling EMA3D Charge with AGI STK.

Efficiently simulate very complex electric arcs with optimized mesh engines and streamlined workflows.

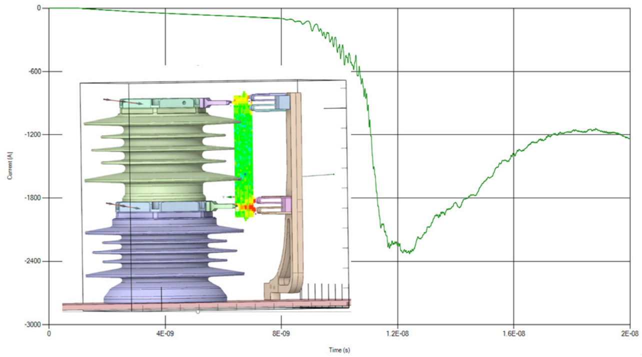
Examine with full confidence how an Electrostatic Static Discharge (ESD) event in either air or solids may affect your product.



Perform CAD cleaning, simulation initialization, meshing, analysis and visualization of all charging and discharging problems in one streamlined workflow integrated into Ansys SpaceClaim.

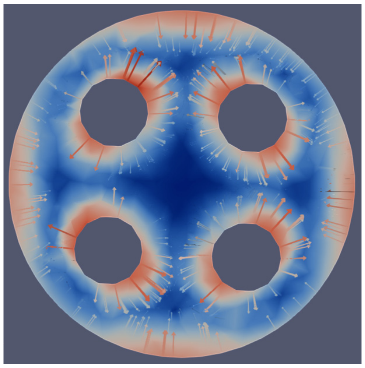


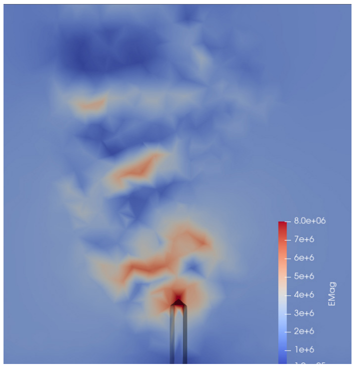
Surface Flashovers - PCB



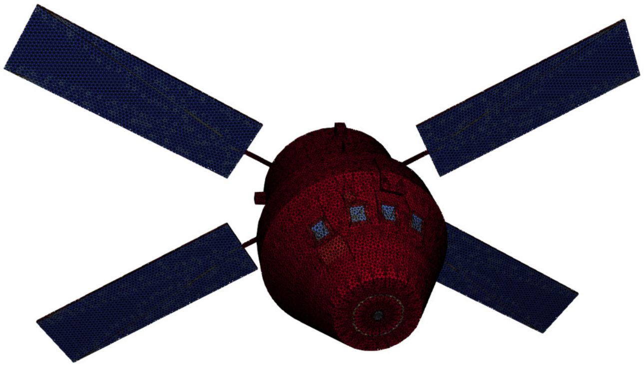
Arc Current Waveforms – EMI Testing

Ansys EMA3D Charge addresses numerous charging and discharging phenomena:





Internal Charging and ESD in Solid Dielectrics – Integration with STK



Surface Charging – GEO, Auroral, LEO, Tribo

- **Air breakdown** in high-voltage systems takes advantage of a finite-element time difference method and a nonlinear air chemistry module to model arcing at various air densities and humidities.
- **Surface Charging** in low and high energy plasma environments, as well as through triboelectrification, is possible using highly optimized charge balance equation solvers.
- **Internal charging** of solid materials from high-energy particle fluxes leverages the coupling of a 3D particle transport source and a full-wave electromagnetic finite element method (FEM).
- **Coupled charging** simulations take advantage of the charge balance equations solvers, the FEM and the 3D particle transport tool to self-consistently solve the 3D electric fields generated from a surface charging problem.
- **Dielectric breakdown** in solid dielectric materials is simulated once the local fields exceed the dielectric strength of a given material, using the coupling of the FEM with the 3D particle source and a stochastic tree model.

What Differentiates Ansys EMA3D Charge?

- Arcing simulations are validated against consulting experience and current industry standards such as IEP 61000.
- EMA3D Charge is capable of accurately simulating current waveforms generated from the complex physics of ESDs to address EMI concerns.
- The software combines 3D particle transport with other transient simulations, such as a full wave FEM simulation of electromagnetic waves in solids.
- Unique integration with AGI STK-SEET helps tackle charging risks in time-varying plasma environments present in orbit transfers or highly elliptical orbits.
- EMA3D Charge can self-consistently couple numerical methods to tackle complex charging environments.
- The software can perform charging and discharging analysis of CAD designs in a single smooth workflow.

CAPABILITIES

NONLINEAR AIR CHEMISTRY	Model the creation and annihilation of charge carriers during the formation of the arc in air of varying density and humidity.
MATERIAL CHARGING	Evaluate the charge accumulation from friction, electrostatic induction, contact charging, solar illumination and plasma interactions in and on any materials by using the mesh engines and the physics solvers of Ansys EMA3D Charge.
3D PARTICLE TRANSPORT	Track electrons, photons, protons, etc., and their interactions with bulk materials. The coupling of the particle transport source to the FEM provides an efficient method to track changes in charge density and electric fields. In turn, those local fields will affect particles trajectories at later simulation times.
NEAREST NEIGHBOR APPROXIMATIONS AND ITERATIVE SOLVERS	Optimize the surface charging simulation workflow by using approximate solutions to the charge balance equations that reduce computational time and resources.
ANALYTICAL TIME-VARYING VOLTAGE AND CURRENT SOURCE	Provide time-varying current and voltage sources as boundary conditions of an internal or surface charging problem to tackle precipitation statics, triboelectric charging and more.
SELF-CONSISTENT COUPLING OF SOLVERS	Tackle complex charging physics simulations by coupling the internal charging and surface charging workflows, such as the effect of plumes or high-energy particles on the charging of material surfaces.
TIME-VARYING PLASMA ENVIRONMENTS	For both high- and low- energy plasma environments, you can provide time varying parameters to monitor consequential charging effects.
RADIATION HARDENING	Easily implement radiation shielding and test changes in material properties based on required radiation tolerance.
FULL-WAVE SOLUTIONS IN FDTD AND FEM	With the time-domain solutions offered in Ansys EMA3D Charge, you can solve for the electromagnetic fields across the full frequency spectrum to provide accurate solutions of time-varying initial conditions.
PARTICLE-IN-CELL SIMULATION (COMING SOON)!	Simulate the effects of local EM fields on plasma environments surrounding the CAD model to accurately predict the induced surface currents.

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