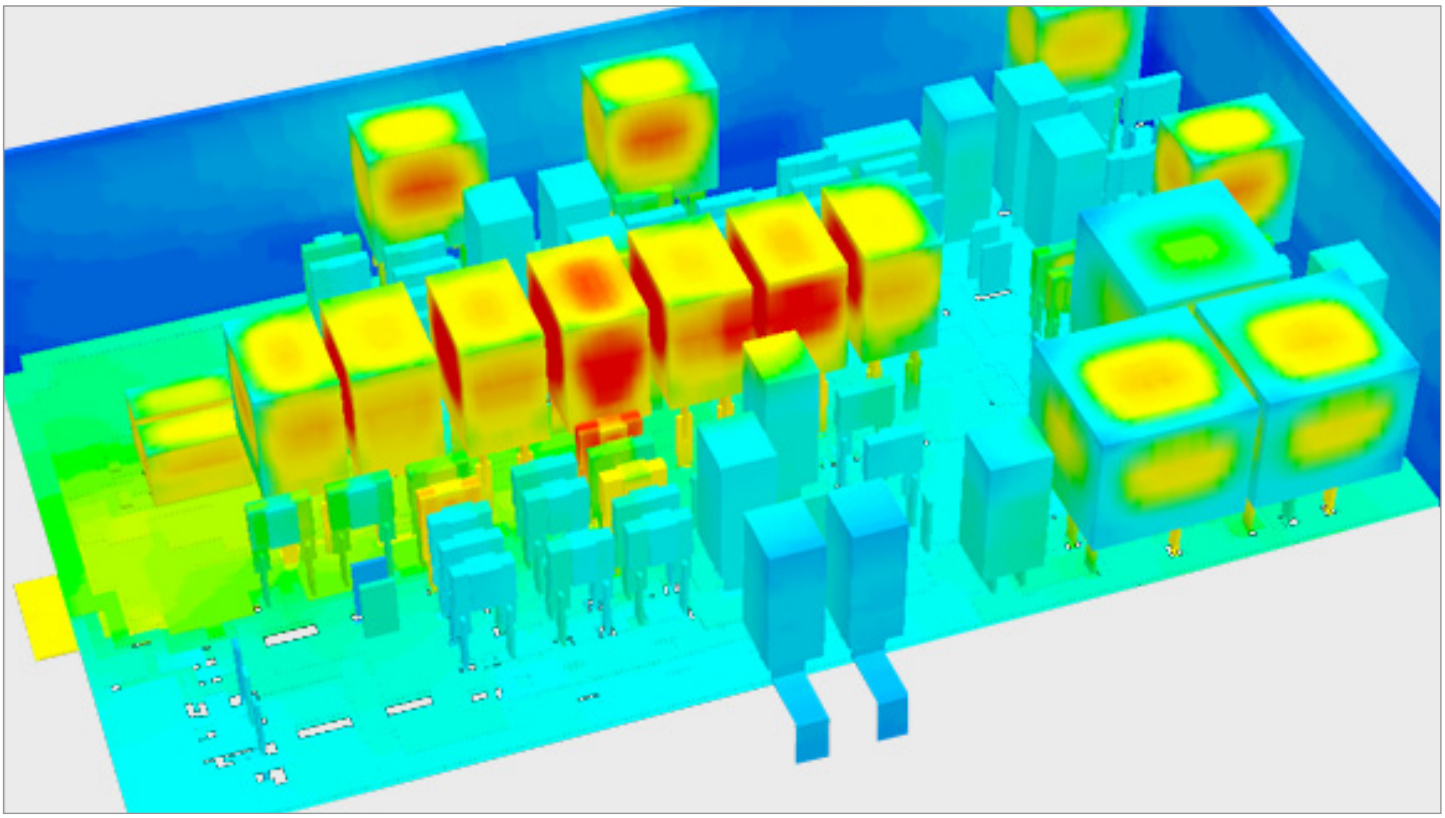
# Altair ElectroFlo™

Electronics Thermal CFD Management Software

Altair | HyperWorks



Altair ElectroFlo is a CFD-based thermal package to simulate challenging electronics cooling and other EDA thermal management applications. Easy to use even for non-CFD experts, it is capable of solving complex problems involving conduction, natural and forced convection, radiation and conjugate heat transfer.

## Product Highlights

- Coupled electrical analysis
- 1D Flow network co-simulation and patented radiation solver
- Embedded thermal/electrical networks
- Fully automated modeling approach for common procedures
- Extensive error-checking
- The object-oriented modeling makes the software easy to use

Learn more:
**altair.com/electroflo**

## Benefits

ElectroFlo is designed exclusively for challenging electronics cooling and design applications. Utilizing an object-based modeling approach, it achieves unprecedented ease-of-use through extensive error-checking and automation. Its solver leverages a stable and powerful computational fluid dynamics (CFD) core; but, the solver's true strength comes from its "hybrid" approach coupling multi-physics and various solution methodologies with mixed fidelity.

These include electrical co-simulation for joule heating (self-heating) of traces and conductors, integrated 1D flow networks for modeling liquid channels and integrated thermal, electrical R/C networks for mixed fidelity modeling.

## Capabilities

**Coupled Electrical Analysis**

- Voltage field solved in parallel with updated resistivity to evaluate Joule heating distribution
- Accurate accounting for self-heating of traces and electrical conductors to avoid costly over designs

**1D Flow Network Co-simulation**

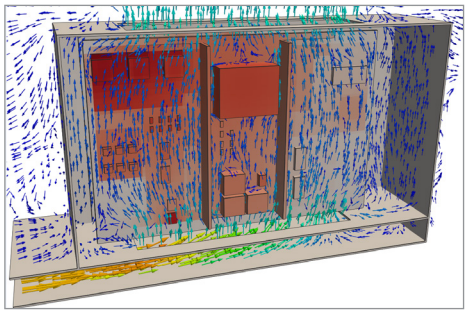
- Integration of complex "Flow Network Systems" into the model
- The ability to model liquid cooling channels and cold-plates with little impact on computer resources

**Patented Radiation Solver**

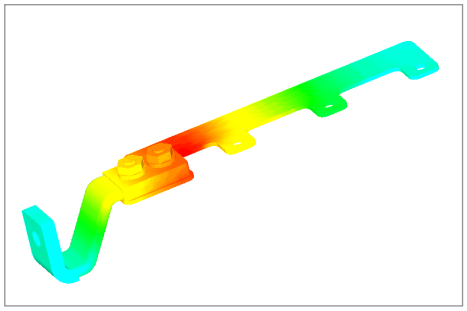
- Automatically combines element surfaces to have a more reasonable radiation mesh that is not dictated by the extreme details of the problem

**Embedded Thermal/Electrical Networks**

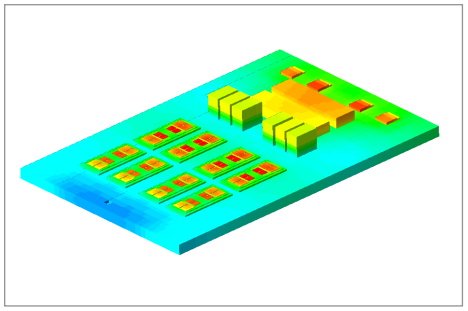
- Allow integration of thermal and/or electrical resistive network circuits in the model with no limitations on the complexity of the circuits
- Add internal details of components; connect system to environment



*Electronics control module*



*High-current bus bar*



*Liquid cooled cold-plate*

**Object Oriented Modeling**
- Boundary conditions are applied using full associativity between Objects, Loads and Functions.
- The user selects application region, enters a constant value or point to function(s)/ table(s) for varying values.
- Modify/copy objects will automatically modify/create BC's accordingly

**Automation**

Fully automated modeling approach for common procedures:
- Mesh: Fully automated with user-controls for refinements
- Model Clean-up: One-click fully automated; or with user-control on selected objects
- Electrical Circuit Detection: Fully-automated procedure to detect electrical regions using element resistivity and electrical links

**Extensive Error-checking**
- Check material definition prior to run
- Electrical BC's applied to conductors

With user interface and technical features focused on electronics application, ElectroFlo delivers increased accuracy while reducing modeling and simulation time.

**Model Manager Listview**

Gives user a glance at the entire model allowing modification of several objects at once.
- Treeview used to populate listview
- Color by object, type, material
- Sort by type, power, temperature, and material.
- Create groups/assemblies
- Copy/rotate/translate/mirror

**User-extensible Libraries**
- Components, convection, material properties and TIM's

**Define Varying BC's by Pointing to Functions/Tables**
- Time, temperature and/or spatial dependence
- Periodic functions, inverse functions and thermostat controls
- Polynomial, exponential, sinusoidal, read from file
- Use multiple functions to define temperature dependence with duty-cycle definition

**Use of 2D Solids for Efficient Modeling of Board Layers**

**Geometry Import:**
- CAD, IGES, ODB++, IDF formats
- CSV component placement tool
- User specified tolerance
- Tools for intelligent import to capture needed features, discarding thermally irrelevant details

**High Current Applications:** In these applications a significant amount of heat is generated in various conductors and traces due to flow of electrical current.
- Automatic detection of circuits
- Solve voltage field for accurate prediction of self-heating effects
- Current/voltage BC's
- Electrical links and nodes to add circuit details with minimal impact on resources
- Bolted joint losses modeled using electrical/ thermal plane resistance

**Vents and Fans**
- Associated to walls Fan flow fixed or using fan curve
- Can model swirl, rotation, hub heat dissipation

**Analysis**
- Laminar, Turbulent
- Steady-state, Transient
- CFD, non-CFD, frozen CFD
- Modify running job
- Components thermal margin tracking

**Liquid Cooled Applications:**

Due to extremely high heat flux, the cooling is achieved using embedded channels with compact heat exchanger cores. CFD modeling of heat exchanger core is not feasible Due to details of heat exchanger fins.
- ElectroFlo's 1D flow network co-simulation is ideal approach
- User provides flow paths and channel cross-section
- Automatic creation of flow nodes and solid fluid interfaces
- Automatic creation of convective and advective resistors
- Heat exchanger UA from correlation, test data or performance charts

**Post-processing**
- 3D plots with option to draw on original CAD
- Cut-plane fringe plots
- Velocity vectors sized by velocity magnitude, colored by any scalar
- Volumetric Region reports result quantities in any volume
- Planar Region shows any result flux through a plane
- Automated results export to ParaView for advanced post-processing

**Other Capabilities**
- Session file tracks command history
- Crash recovery