ALPHA-Numerics GmbH

Electronics-Cooling-Partner for simulation services & consulting

What? When? How much?

We act as an extended workbench

With the miniaturization of electronics, the constantly increasing variety of functions and the growing requirements in the field, every electronics developer will sooner or later come up against the maximum permissible temperatures of their products. Whether it is the junction temperature of the components, the melting point of the solder or the warranty, which stipulates a minimum product life cycle - temperature is an issue that has become an integral part of product development.

It is not only big companies that are faced with this challenge, but also medium-sized and small companies, which only must deal with this topic 2 to 3 times per calendar year. For these companies, the question arises as to whether their own expertise should be expanded by installing a simulation workplace in addition to the measuring laboratory or whether this expertise should be acquired from external service providers.

This information flyer deals with the offer of "simulation services" by the company ALPHA-Numerics. What is the meaning of simulation services for the electronics cooling sector? Which key data should be specified as input data in order to be able to generate a certain depth of results? How does ALPHA-Numerics support you in the optimization process and what can you derive from it for future projects?

We have found that new prospective customers, who may even have had experience with external simulation service providers in previous years, are surprised at how quickly and easily such a collaboration can take place nowadays and how inexpensive this consulting service has become.

ALPHA-Numerics GmbH uses the CFD simulation tool CelsiusEC from Cadence. This analysis tool, which is tailored to electronic products, offers the right mix of import functions, intelligent objects (with a smart physical representation of all functions) and robust solvers to keep the effort manageable in combination with an experienced user like ALPHA-Numerics.

We are faster
than you think.

And the transfer of knowledge is immense!

After an hour kick-off meeting and order processing, it usually takes between one and five days to provide you with initial simulation results. This is usually followed by an online meeting to discuss the results, and the optimization potential together and possibly define further versions to simulate.

01 Initial discussions are non-binding and free of charge

02 What data is required - Prices

03 How does a collaboration with ALPHA-Numerics work?

ALPHA-Numerics GmbH

Specialist for optimized thermal management for electronic systems with almost 30 years of experience in the field of CFD simulation.
We help you to research the right input data, discuss with you the worst-case scenario suitable for your product environment, give you initial tips on a sensible cooling concept, simulate the actual state, advise you on the results and show you the optimization potential. And all this as an engineer among engineers.

We speak the same language!

Extended workbench - what does this mean?

We are not a typical engineering office that takes on entire product developments for you independently. We work as an "additional specialist" integrated into your team. We are the virtual simulation department that checks and optimizes the cooling concepts of your products together with your designers and hardware developers.

This gives you the added benefit of understanding our thought processes during optimization and building up your own wealth of experience for future projects.

Should you wish to simulate yourself at some point...
...we are also your first contact of call as a software dealer.

We represent Cadence as an official dealer for the CFD software CelsiusEC (**E**lectronics **C**ooling). As the virtual engineer of your team, we know your products at this point and train your engineers with CelsiusEC on your own projects.
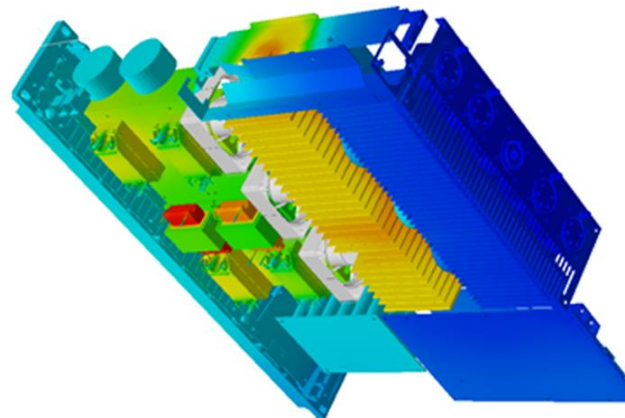
In this flyer, we are unfortunately unable to cover all the industrial sectors in which we are active as a service provider. In addition to our major customer areas such as automotive technology (lighting, control systems, hi-fi, GPS, display technology, charging infrastructure), automation technology and high-power applications, we naturally also support the product areas of lighting technology, medical technology, telecommunications & network technology and everything in the field of power tools.

01 Initial discussions are non-binding and free of charge

As early as the concept phase, the question often arises as to who you should work more closely with in terms of thermal considerations and when. Which competencies do you want to access, and which service provider offers the right mix of industry sector expertise, reliability, flexibility and speed? What would this ultimately cost for the current project?
There are also uncertainties as to which data would have to be bundled and delivered to the service provider for a simulative analysis in order to actually obtain the desired answers.

As there is no lack of product diversity in the electronics industry and different product areas *(transportation, e-mobility / charging structure, automation technology, medical technology, lighting technology, telecommunications and many sub-sectors such as display technology, mobile communications / GPS, and many more)* also place different demands on the data and their level of detail, we offer every interested party an initial free kick-off meeting when starting a new project. This is non-binding and serves as a mutual introduction and an initial discussion of the product concept and simulation requirements.

In this first kick-off, ALPHA-Numerics discusses the simulation- and consulting-options and clarifies in the first step which further details are required in order to provide you with a reliable cost estimate for the simulation service and an optimization consultation.
In most cases, a non-disclosure agreement is signed in advance so that the data rights remain with the customer and data security is guaranteed during the collaboration.

02 What data is required?

The data required for our input always depends on the time of the collaboration in terms of the status of product development.

- Quotation preparation

- Simulation supports product development
  - Design phase I - Concept phase without CAD
  - Design phase II - rudimentary CAD data and good PCB & component data (without layout) are available.
  - Design phase III - detailed CAD data as well as PCB layout and component data sheets are available.

- A finished product design does not pass approval or fails in the field

It should be noted here that with integrated purchased products in your device, for which you have no detailed data from your supplier (displays, power supply units, etc.), we can usually fill these gaps with our experience in order to create a reliable simulation model.

Information required for preparing the quotation (please clarify the need for a NDA in advance)

Project name	
Time critical	Yes / No
Mechanical details	Sketch / CAD-rudimentary / CAD-detailed
PCB task	Signal processing / High-Power-Application
PCB details	PCB-details: 5 copper distribution per layer / Layout available
Total power loss	_____ (W)
Power loss distribution	5-10 Parts / 11-20 Parts / >20 Parts
Fan	No / Yes – 1 fan / Yes – 2 fan / Yes – 3 fan / Yes - > 3
Fluid cooler	Yes / No
Dokumentation target	Steady state / Temporal view
Optimisation calculation	Desired (approx. 1h) / not desired
On-site workshop	Desired / not desired

Of course, we can also take on small simulation tasks in a sub-system unit, such as just the fluid cooler, a component/heat sink combination, a pure airflow study, etc.

In addition to answering this rudimentary checklist on the left, a task as a continuous text would help for a basic understanding. Possibly one or two sentences about the challenges you have encountered.

After receiving this information, we will contact you to schedule the first, non-binding meeting.

In addition to this initial information, we also need the CAD data (from level of detail II) to understand the complexity of the structure. You can send these to us before or after the first meeting.

We can currently read the following formats (as of 01-2025)

3D CAD Model

ACIS (*.sat *.sab *.asat *.asab)
CATIA V4 (*.model *.session *.exp)
CATIA V5/6 (*.catpart *.catproduct *.cgr)
IGES (*.igs *.iges)
Inventor (*.ipt *.iam)
MOBJ (*.mobj)
NX (*.prt)
Parasolid (*.x_t *.x_b *.xmt_txt *.xmt_bin *.xmp_txt *.xmp_bin *.p_b *.p_t)
Pro/E (*.prt *.prt.* *.asm *.asm.*)
STEP (*.stp *.step *.stpZ *.stpx)
STL (*.stl)
SolidWorks (*.sldprt *.sldasm)

AFTER the order has been placed, the following data is required to start building the model.

Design phase I

Despite this early design phase, in which little information is usually available, our simulation and consulting services can still generate well-founded results for some product development decisions.

- Do you have an old project and want to build on its product design to plan the next generation with more performance and functions? We will check for you where the limits of feasibility lie.
- Would you like to carry out an initial heat sink selection and optimization in limited assemblies and test this task in different directions of gravity? We can perform such small variant analyses at any time or even carry them out live during a joint workshop / brainstorming session to optimize the heat paths.
- The enclosure concept has been sketched out and you are looking for the optimum positions for the air inlet and outlet? How does free convection affect the finned housing at different mounting angles? We can also quickly realize such concept designs in our simulation software.
- Would you like to analyse the temperature distribution with very rough power loss distribution on PCBs, regions or simple volume objects and give the product architecture the right direction at an early stage? Such simple, fast simulations can be generated on the basis of hand-drawn sketches.

Such small studies can be implemented quickly and are cost-efficient. At the same time, you receive a transfer of knowledge from us regarding the heat paths, the barriers and the optimization potential in this phase.
Depending on the scope of the consultation, we usually charge between € 500 and € 1,500. Of course, we can provide you with advice over a longer period of time and, if required, also offer training in the specialist field of electronics cooling and/or organize a joint workshop during the concept phase.

Design phase

Rudimentary CAD data and good PCB & component data (without layout) are available.

Once the concept is in place and the construction department and hardware designers are working on the first models, nothing stands in the way of a more detailed simulation model.

For a reliable model in this design phase, we need the following data:

- Design data, i.e. complete, non-simplified assembly, preferably in STEP format (AP214)
- PCB geometry and component placement can be used from the CAD design
- PCB stack, i.e.
    - Number of signal layers
    - Signal layer thickness
    - Estimation of copper coverage per signal layer in "%"
    - Are thermal vias being considered? Where, how much? CU-filled or CU-coated? We can also add these to our tool.

- Rough material allocation for the mechanics
  - Aluminium AWxxxx - for the right thermal conductivity value
  - Plastic (no exact designation necessary for the time being)
  - Assign other metals such as copper, brass, steel
  - Thermal pads, pastes with thermal conductivity value, thickness, position
- Fan data sheet
- Fluid cooler
  - Designate inlet and outlet
  - Cooling medium e.g. water-glycol 50/50
  - Inlet temperature
  - Volume flow /pump output
- Power loss distribution (allocate approx. 80% to the main power loss carriers)
  - Distribute to objects, surfaces or entire PCBs
  - A data sheet would be helpful for special power sources such as Mosfet, LED, FPGA, CPU etc.
- Description of the surroundings
  - Temperature
  - Gravitational direction
 - Mounting situation on wall or table or free-standing in the room

With these details, simulation statements can already be generated very precisely.

Design phase III / close to device approval or field returns

Detailed CAD data as well as PCB layout data & component data sheets are available.

The further the development cycle progresses, the more detailed data is available. In addition to the level of detail II, the following data is usually added to the simulation model:

- Detailed design data, i.e. complete, non-simplified assembly preferably in STEP format (AP214), native data formats can be clarified
- PCB data can be used in the following formats:

ODB++   IPC-2581   Allegro   Other EDA   Legacy PCB
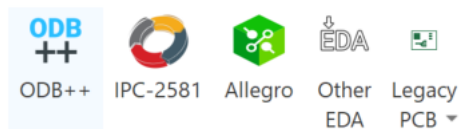
By "other EDA formats" we mean *.spd and by "legacy formats" we mean Gerber or IDF data.

With all these details, simulations can be generated with a tolerance of 1-3 Kelvin accuracy to the later measurement. The question here is rather how accurate these measurements are and how well the measurement reflects the later place of use.

> **For all 3 detailed phases, it should be noted that the simulative analysis can only consider the steady state, but also time related progressions. A clocking of the power losses or a temperature-dependent control of the fan are easy to define.**

03 Procedure for working with ALPHA-Numerics?

To keep it short and concise, we have summarized a typical process in a flow chart according to the most important milestones.

1. Inquiries from interested parties by telephone, e-mail or conversation at a conference or trade fair.
2. Possible first Teams-meeting without NDA (non-disclosure agreement) for a mutual introduction and rough project outline.
3. Mutual signing of the NDA. All rights to the data remain with the customer.
4. Data according to the checklist for preparing a quotation is sent to ALPHA-Numerics.
5. ALPHA-Numerics views this data, imports it into CelsiusEC and invites you to a kick-off meeting.
6. Approx. 1h meeting for model explanation and clarification of questions / task specification. If we understand the task and your expectations, we can also provide you with a reliable quotation. The price is usually roughly calculated and communicated at the meeting.

Up to this point, everything was free of charge and without obligation.

7. Quotation is sent to the interested party. In most cases, you will be told when we can start the project and how long it will take to deliver the results. Usually faster than you expect 😊.
8. Incoming orders at ALPHA-Numerics.
9. ALPHA-Numerics will send you a list of the detailed data still required to solve this task to your satisfaction.
10. Final data receipt and setup of the simulation project. If you have any questions during the modelling work, we will call you briefly or send an e-mail. In this phase it is important that you are easy to reach.
11. If necessary, Teams-meeting again for 20 minutes to check the simulation model together to ensure that there were no misunderstandings.
12. Calculation of heat paths (heat conduction, convection, heat radiation (outdoor influences are also possible)).
13. Reporting and dispatch.
14. Invitation to a joint discussion in Teams.
    a. Presentation of the simulation results and explanation of the effects
    b. Concrete discussions on the bottle necks and optimization options
    c. Possible definition of further variant simulations to optimize the product
15. With this results meeting, we will also send the invoice matching the order.

Have we piqued your interest?

THEN we would be delighted to hear from you!

Please feel free to contact me directly. I will try to get back to you as soon as possible:

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