Despite asymmetric air flow power components show the same temperature. Results are created using CoolIt, a software product of Daat Research Corp.
Thermal simulation with computational fluid dynamics (CFD) allows the engineer to dimension his system in great detail. Especially in complex systems life expectancy of electronic components, space, mass and cost may be optimized. The analysis of temperatures and air flows helps to take the right measures such as adjusting air flow, positioning of power components, dimensioning of heat sinks and fans and others. AMS Technologies has done more than 230 studies for customers since the year 2000.

**Forced Convection**

Cooling power semiconductors with heat sinks and forced air requires a precise dimensioning of heat transfer and fluid flow. With CFD simulation, it is possible to accurately calculate pressure drop, flow behavior and heat transfer conditions. In computing design variants the position of power modules, heat sink geometry, venting system and other design parameters can be optimized. The example shows guide blades of a turbine that are used to cool IGBTs. Picture: Guide blades of turbine for air conditioning of passenger cabin in aircraft. Results are created using Coolit, a software product of Daat Research Corp.

**Natural Convection**

For components that are mainly to be cooled by natural convection it is necessary not only to model ambient and boundary conditions, but also heat transfer through heat conduction and radiation. The computer simulations allow for accurate calculation of the energy balance such that targeted design modifications as an insulation or enlargement of cooling surface may be incorporated. Picture: Electric motor with thermally decoupled electronics box. Results are created using Coolit, a software product of Daat Research Corp.

**Systems**

Systems of the size of meters can be investigated with CFD. As with natural convection it is important to model the individual heat transfer mechanisms convection, conduction and radiation in great detail. Picture: Reagents chamber with extraordinary homogeneous temperature distribution. Results are created using Coolit, a software product of Daat Research Corp.

**Liquid Cooling**

Computer simulations are suitable for predicting and designing complex water channels that cannot be calculated with standard formulas. The fluid channel geometry may be optimized for low pressure drop and enhanced heat transfer. Picture: Pressure drop in water channel with pin fins for IGBT cooling. Results are created using Coolit, a software product of Daat Research Corp.
Thermoelectric Cooling

In a thermoelectric assembly cooling capacity, operating conditions of the thermoelectric modules and heat dissipation on the hot side are tightly coupled to each other. The computer simulations make it possible to investigate and optimize energy balance and efficiency of a system in one overall model.

Picture: Reagents cooled by a thermoelectric assembly.

Results are created using Coolit, a software product of Daat Research Corp.

Short Development Time - Optimized Designs

The development with computer simulation is usually a joint effort of customer and AMS thermal design engineers to optimize thermal performance, space constraints, cost and other targets. As a result the customer receives a blueprint that was optimized for his application. AMS Technologies also uses the experience of its suppliers and guarantees that the hardware will perform as computed.

Picture: Optimization progress

Safety

Models must appropriately simulate heat transfer and fluid dynamic behavior. Experienced engineers catch the important details and omit others. They validate and refine the models for good accuracy of predictions. Computations are done with Coolit® from Daat Research www.daat.com. In 9 years AMS Technologies has made more than 230 reports for aircraft electronics, medical equipment, power conversion, optoelectronics and other electronics applications.

Picture: Extract of report for automotive application

Requirements

Accuracy of input data is crucial for correct predictions of heat transfer and fluid dynamics. Geometry data can be supplied in DWG, STEP or STL-files or in drawings with main measurements.

<table>
<thead>
<tr>
<th>Heat source</th>
<th>Heat dissipated (W)</th>
<th>Allowable T_{max} (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGBTchip</td>
<td>14</td>
<td>110</td>
</tr>
<tr>
<td>Diode</td>
<td>8</td>
<td>110</td>
</tr>
<tr>
<td>Peltier</td>
<td>100</td>
<td>45</td>
</tr>
<tr>
<td>CPU</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>DC-DC converter</td>
<td>7</td>
<td>105</td>
</tr>
</tbody>
</table>

Our Offer

AMS Technologies makes an assessment of the problem and the effort necessary for its solution. Studies are then conducted at fixed conditions.

Contact our sales engineers - AMS is looking forward to your inquiry!

<table>
<thead>
<tr>
<th>Component</th>
<th>Material</th>
<th>Heat conductivity (W/mK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat sink</td>
<td>Aluminum die cast</td>
<td>150</td>
</tr>
<tr>
<td>PCBs</td>
<td>FR4 w/ 2 oz. Cu</td>
<td>0,26</td>
</tr>
<tr>
<td>Compound</td>
<td>Stycast</td>
<td>1,85</td>
</tr>
<tr>
<td>Heat source</td>
<td>Silicon</td>
<td>125</td>
</tr>
<tr>
<td>Thermal grease</td>
<td>Non-silicone</td>
<td>1</td>
</tr>
</tbody>
</table>

Example of input data supplied by customer
enabling your ideas.
Optical, Power and Thermal Management Technologies

- **GERMANY**
  AMS Technologies AG
  Fraunhoferstr. 22
  82152 Martinsried, Germany
  Phone +49 (0) 89 89 577 0

- **FRANCE**
  AMS Technologies S.A.R.L.
  Silic 649 – Bâtiment Magnolia
  16, avenue du Québec
  91945 Courtaboeuf Cedex
  Phone +33 (0) 1 64 86 46 00

- **ITALY**
  AMS Technologies S.r.l.
  Corso Sempione, 215/B
  20025 Legnano (MI), Italy
  Phone +39 0331 596 693

- **POLAND**
  AMS Technologies Sp. z o.o.
  Mogiliska 69 ST, Floor 2
  31-545 Kraków, Poland
  Phone +48 (0) 12 346 24 16

- **SPAIN**
  AMS Technologies S.L.
  C/Filadors 35, 9, 7º
  08208 Sabadell, Spain
  Phone +34 93 380 84 20

- **SWEDEN**
  AMS Technologies Nordic
  Aspect Photonics AB
  Aminagatan 34
  43153 Mölndal, Sweden
  Phone +46 (0) 8 55 44 24 80

- **UNITED KINGDOM**
  AMS Technologies Ltd.
  Nene House, Drayton Way
  Daventry, Northamptonshire
  NN11 8EA, United Kingdom
  Phone +44 (0) 1455 556360

Copyright 2018 by AMS Technologies Rev. 13-18-03

info@amstechnologies.com
www.amstechnologies.com
www.amstechnologies-webshop.com