scSTREAM

Cradle
MSC Software Company

Heat Dissipation of Lighting Equipment and Optimization

Optional Function

Effective Use of Optimization Tool for Heat Sink Design

Purpose of Optimization

The modeling of heat sink needs to:

1. Reduce the LED temperature to the regulation
   Rising LED temperature [ΔT°C]:
   Minimized (ΔT: below 40°C)
2. Miniaturize itself
   Heat sink volume [weight]:
   Minimized (below 0.0005m³)

Optimization methods

■Experiment plan and sampling method

Central composite design ⇒43 samples

■Approximation of multiobjective optimization

Method of application ⇒RBG

Method of multiobjective optimization ⇒NSEA+

■Applications used

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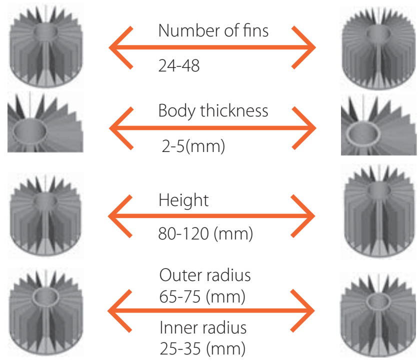
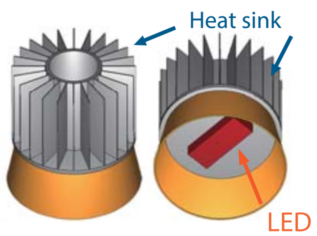
Optimus® for Cradle

Design variables

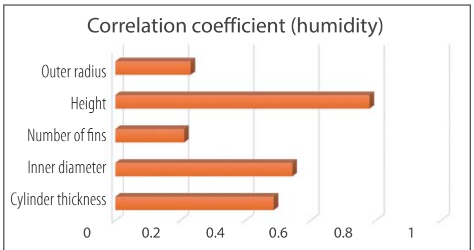


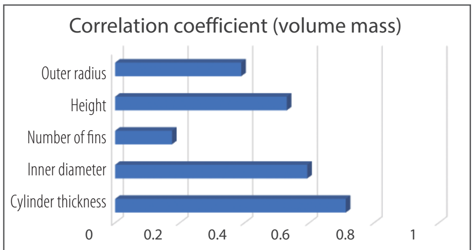
Change design variables for sampling

Original model



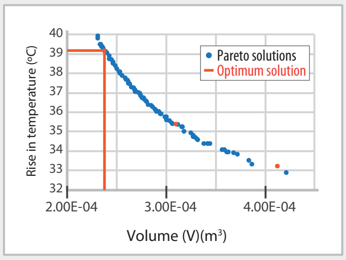
Sampling results





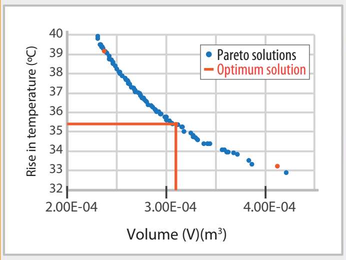
- The strong correlation between the number of fins, fin height and outer radius shows that the increase in these factors encourages temperature reduction.
- In terms of volume mass, the correlation between the number of fins, fin height, and outer radius is strong.

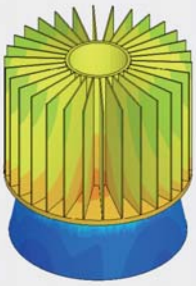
Optimum Designs Derived from Pareto Solutions



Priority on light weight

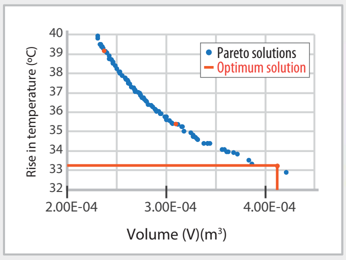
Volume	2.40×10-4 [m³]
Rise in temperature	39.1 [°C]
Number of fins	28 [pieces]
Heat sink height	82.5 [mm]
Thickness of cylinder	2.4 [mm]
Outer radius	72.8 [mm]
Inner radius	25.0 [mm]

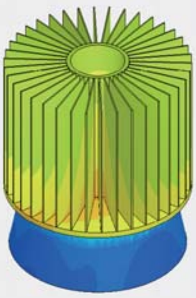




Priority on balance

Volume	3.11×10-4 [m³]
Rise in temperature	35.4 [°C]
Number of fins	30 [pieces]
Heat sink height	104.9 [mm]
Thickness of cylinder	2.9 [mm]
Outer radius	74.4 [mm]
Inner radius	26 [mm]





Priority on heat dissipation

Volume	4.12×10-4 [m³]
Rise in temperature	33.3 [°C]
Number of fins	38 [pieces]
Heat sink height	115.6 [mm]
Thickness of cylinder	3.5 [mm]
Outer radius	74.7 [mm]
Inner radius	25.1 [mm]

Notes

Optimization is effective to pinpoint design variables to the values that fulfill the objectives. Or, in many cases, it also plays an important role in the early stage of design process to identify that the proposed ranges of design variables cannot physically serve the intended purposes. On the other hand, optimization sampling requires a collection of analysis examples. Because of this, it is important to minimize the number of design variables as well as to choose the most appropriate analysis software with high computation performance.