Evolution of Heat Flow Prediction Models for FPGA Devices

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1 Motivation

On today's integrated curcuits there is a considerable potential of generating high temperatures, due to shrinking devices and increasing frequencies. Especially FPGAs can generate local hotspots and alarmingly high temperature increases with only a rather small resource utilization [1]. For many cases the accurate temperature estimation and prediction is becoming increasingly important.

2 Formulation of problem

In order to predict temperatures it is mandatory to automatically determine a temperature model, as proposed in [2]. The model's parameters have to be parameterized by several measurements. Quality criteria for the obtained thermal model are predictive accuracy and the effort of model generation.

3 Objective target

In order to obtain an accurate thermal model, the temperature model given in [2] needs to be implemented. Its parameters will be adjusted by using combinatorial optimizing algorithms, like Simulated Annealing, evolutionary strategies and so on. The quality of the obtained temperature model will be evaluated by comparing it with the general models given in [3] and [4].

4 Time management

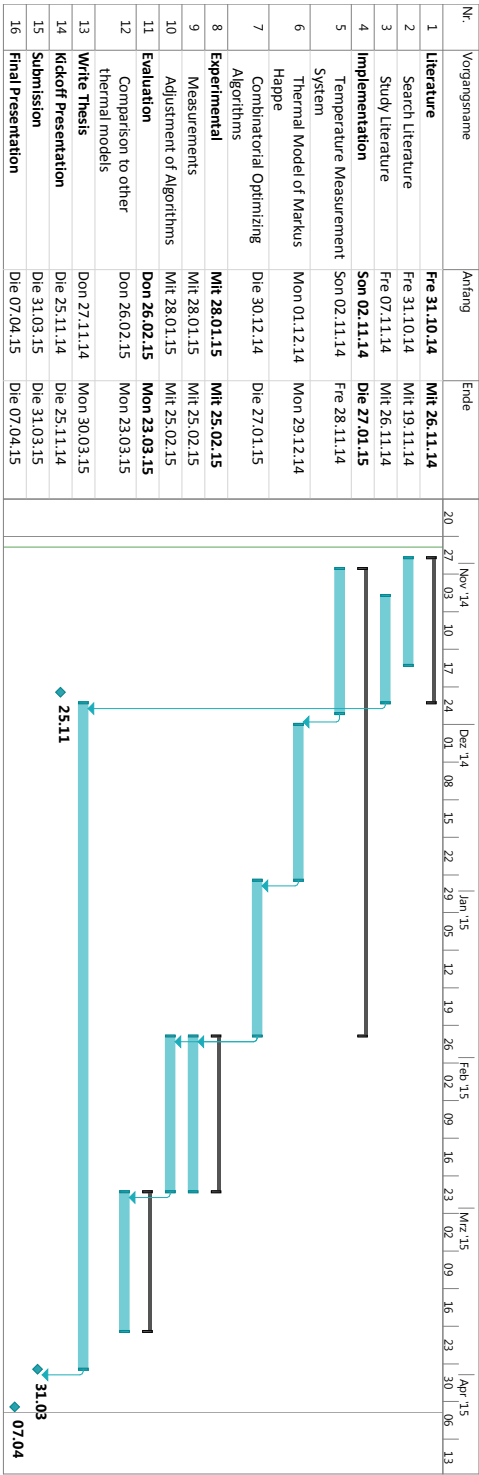| Nr.	Vorgangsname	Anfang	Ende
1	**Literature**	**Fre 31.10.14**	**Mit 26.11.14**
2	Search Literature	Fre 31.10.14	Mit 19.11.14
3	Study Literature	Fre 07.11.14	Mit 26.11.14
4	**Implementation**	**Son 02.11.14**	**Die 27.01.15**
5	Temperature Measurement System	Son 02.11.14	Fre 28.11.14
6	Thermal Model of Markus Happe	Mon 01.12.14	Mon 29.12.14
7	Combinatorial Optimizing Algorithms	Die 30.12.14	Die 27.01.15
8	**Experimental**	**Mit 28.01.15**	**Mit 25.02.15**
9	Measurements	Mit 28.01.15	Mit 25.02.15
10	Adjustment of Algorithms	Mit 28.01.15	Mit 25.02.15
11	**Evaluation**	**Don 26.02.15**	**Mon 23.03.15**
12	Comparison to other thermal models	Don 26.02.15	Mon 23.03.15
13	**Write Thesis**	Don 27.11.14	Mon 30.03.15
14	**Kickoff Presentation**	Die 25.11.14	Die 25.11.14
15	**Submission**	Die 31.03.15	Die 31.03.15
16	**Final Presentation**	Die 07.04.15	Die 07.04.15

Figure 1: Time schedule

References

[1] Andreas Agne, Hendrik Hangmann, Markus Happe, Marco Platzner, and Christian Plessl. Seven recipes for setting your FPGA on fire A cookbook on heat generators. *Microprocessors and Microsystems*, (0):–, 2013.

[2] Markus Happe, Andreas Agne, and Christian Plessl. Measuring and predicting temperature distributions on FPGAs at run-time. *Reconfigurable Computing and ...*, pages 55–60, 2011.

[3] Wei Huang and Shougata Ghosh. HotSpot: A compact thermal modeling methodology for early-stage VLSI design. *Very Large Scale ...*, 14(5):501–513, 2006.

[4] S.S. Sapatnekar and Yong Zhan. Fast Computation of the Temperature Distribution in VLSI Chips Using the Discrete Cosine Transform and Table Look-Up. *Proc. of Design Automation Conference (ASP-DAC)*, 1:87–92, 2005.