

*The offered positions fall into one of the following scientific fields: FPGA prototyping, VHDL/VERILOG programming, computer architecture, computer arithmetic, compilers (LLVM), OS drivers (Android,) graphics algorithms and Neural Network applications.*

### **1. LLVM Compiler Backend and Frontend for GPUs**

LLVM is the main compiler tool used in the company. The purpose of this task is to further optimize the backend or front-end parts of LLVM and perform various optimizations, benchmarking, and verification activities. The underlying architecture will be based on Nema GPU, the new programmable, multicore GPU of the company.

**Skills required:** compiler background, computer architecture, basic knowledge of compiler optimizations.

### **2. VLSI-level Power Simulator for Nema GPU**

One of the current activities of the company is to build a highly accurate power model for the current and under development GPUs. In this task, you will be requested to build a performance monitoring architecture and to gain experience in the latest power simulation/improvement tools of Cadence.

**Skills required:** good knowledge HDL/Verilog, background in power reduction theory.

### **3. Evaluation of Neural and Deep Learning Algorithm in Nema GPUs**

The target is to evaluate and extract specific types of parallelization (data-level, thread level, and task-level) in specific applications from the Neural and Deep Learning domain. The target applications will be based in well-known Neural Network frameworks and will be ported in Nema GPUs.

**Skills required:** good programming skills, parallel architectures.

### **4. Extend the SystemC-based emulator of Think Silicon to support new features**

SystemC is a powerful library facilitating the simulation of computing systems at various abstraction levels. In this project, you are requested to enhance the internal simulator of Think Silicon with new features supporting the execution of OpenCL or OpenGL applications.

**Skills required:** good programming skills, computer architecture, logic design.

### **5. Extending the OpenGL/Vulkan API Implementation with new Features**

The company is developing an end-to-end graphics library and driver to accelerate graphics applications written in OpenGL ES 2.0 and Vulkan standards. As part of this task, it is requested to extend this library with new functionalities (like tracers), perform various benchmarking activities, and further extend the verification framework of the library.

**Skills required:** good programming skills, good knowledge of OS, basic knowledge of OpenGL standard

### **6. Developing and Extending the Shader Editor of the Company**

The company is developing a set of tools for writing efficient code for the GPUs of the company. As part of this set of tools, a dedicated shader editor is being developed. As part of this project, the current shader editor of the company will be extended with new features and it will be ported to a new

framework (e.g., Qt, eclipse, or a Python-based framework).

**Skills required:** C++ and Python Programming languages.

### **7. Extending the NemaGFX graphics API and GUI Builder tool with new Features**

NemaGFX is a low level software graphics library developed by Think Silicon (<http://think-silicon.com/products/software/nemagfx-api/>). On top of NemaGFX, the company developed a new tool, called GUI Builder, that is able to design graphics applications in a drag-and-drop fashion and automatically generate code for Nema GPUs. As part of this project, it is requested to increase the efficiency of the generated code, to enhance the debugging capabilities of NemaGFX, and to extend the features of the GUI Builder.

**Skills required:** Very good background in C/C++ and graphics programming

### **8. Framework for On-Chip Debug Hardware**

The purpose of this project is to build a framework for on-chip debug hardware (JTAG/UART etc). The framework will be applied to Nema GPUs and it should be able to insert HW breakpoints to monitor and visualize the current GPU execution state. Apart from the HW components, an additional SW utility component is needed to illustrate/visualize the GPU state in host PC.

**Skills required:** good knowledge HDL/Verilog.

### **9. Build Sample Games for NemaGFX Library**

NemaGFX is a low level software graphics library developed by Think Silicon (<http://think-silicon.com/products/software/nemagfx-api/>). The purpose of this project is to develop simple and interactive games based on NemaGFX API.

**Skills required:** Very good background in C/C++ and graphics programming

### **10. Automating the Release Process using PYTHON**

The release of a product is a complex process that it is based on automation tools. The purpose of this internship is to update the existing automation tools with various Python based scripts. The end result will be replace the existing automation suite with new features (e.g., different release scenarios) and testing capabilities.

**Skills required:** Linux, Bash script, Python

### **11. Design of a Parameterized Floating Point Unit (FPUs)**

The existing floating point unit (FPU) (ADD/MULT/RCP/SQRT/DIV) of the company causes various simulation/hardware mismatches due to different implementations for ASIC and FPGAs. The purpose of this internship is to build in RTL level (Verilog) a new FPU (based on the existing implementation) to resolve this problem and the associated testbench to ensure that the achieved accuracy is within the acceptable margins.

**Skills required:** good knowledge HDL/Verilog, background in computer arithmetics is desirable

### **12. Convolution Engine in Verilog for AI/DNN Applications**

Neural and Deep Learning applications require heavy convolution operations. The purpose of this

internship is to build in RTL level (Verilog) a new convolution engine. The project includes an architectural analysis, the implementation in verilog (RTL), and the testing of the unit against software implementations (NNPACK).

**Skills required:** good knowledge HDL/Verilog, computer architecture, logic design.

### **13. Adapt Nema Profiler to support RISC-V CPUs**

NEMA|Profiler is a cross-platform profiling tool, enabling software developers to optimize their GPU code without having an in-depth understanding of the GPU architecture. The tool has been developed by the company and includes various code analysis features and visualization capabilities. <https://think-silicon.com/products/software/profiler/> The purpose of this internship is to enhance NEMA|Profiler with new features, so as to perform code optimizations for CPUs like RISC-V.

**Skills required:** good programming skills, computer architecture, good knowledge of OS

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