An Zou

Ph.D. Candidate (4th year)
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Research Interests

Embedded System
Computer Architecture
Robotics
Machine Learning
Digital Circuit Design

Education

- **Washington University in St. Louis** — St. Louis, MO, U.S.
  Ph.D. student in Electrical Engineering; GPA: 3.9/4.0; Advisor: Prof. Xuan Zhang — *Aug. 2016 – present*
  M.S. in Electrical Engineering; Advisor: Prof. Xuan Zhang — *Aug. 2016 – May 2019*

- **Harbin Institute of Technology** — Harbin, China
  M.S. in Automation; GPA: 93/100, Rank: 1/161; Advisor: Prof. Hui Zhao — *Aug. 2013 – July 2015*

- **Harbin Institute of Technology** — Harbin, China
  B.S. in Automation; GPA: 91/100, Rank: 10/123 — *Aug. 2009 – July 2013*

Professional Experience

- **Washington University in St. Louis** — St. Louis, MO, U.S.
  Research Assistant on Computer Architecture and Embedded System — *Aug. 2016 – present*
  Assistant Instructor on ESE 5690 Hardware Acceleration for Machine Learning — *2020*

- **Harbin Institute of Technology** — Harbin, China
  Research Assistant on Embedded System and Robotics — *Sep. 2012 – Jul. 2015*

Research Experience

- **Research Assistant @ XZ Group** — **Washington University in St. Louis**
  Research Area: computer architecture and embedded system — *Aug. 2016 - Present*

1. **Real-time Scheduling for Intelligence Systems** (Aug. 2019 - Present)
   (Embedded System, Intelligence System, Real-time Scheduling, Machine Learning)
   – Develop hardware in-loop drone simulation platform based on NVIDIA Jetson TX2 and Microsoft Airsim simulator.
   – Develop real-time scheduling on Robot Operating System (ROS) within NVIDIA Jetson TX2.

2. **GPU Real-time Scheduling for Artificial Intelligence Applications [J1, C1]** (Aug. 2018 - Present)
   (CPU/GPU Architecture, Embedded System, Linux Operating System, Real-time Scheduling, CUDA Programming, Machine Learning)
   – Implement and characterize AI and ML applications on both embedded NVIDIA Jetson TX2 and GTX1080TI GPUs.
   – Partition and virtualize GPU resources (streaming multi-processor and memory) for multiple tasks and users.
   – Design real-time scheduling algorithms for parallel GPU accelerated AI and ML tasks with hard deadlines.
   – Optimize GPU energy and power efficiency under performance constraints.

3. **Meso Scale Cyber-Physical System Power Management** (Apr. 2017 - Present)
   (Embedded System, Microcontroller, PCB Circuit Design)
   – Design mobile robot platforms PiCar based on a 1/18 scale RC car chassis.
   – Apply upper level intelligence algorithms like computer vision and SLAM on Raspberry Pi 3 / NVIDIA Jetson Tx2.
   – Implement lower level motion feedback control on Arduino.
   – Implement mobile robot sensing with YDLIDAR F4 lidar and Pi camera.

4. **Voltage Stacked Power Delivery for Manycore (GPU) System [J3, C2, C3]** (Mar. 2017 - Aug. 2019)
   (Digital Circuit Design, CPU/GPU Architecture)
   – Model voltage stacked power delivery for manycore processors like GPUs.
   – Propose hybrid circuit level (SPICE 3) charge recycling to mitigate supply voltage noise with worse case guarantee.
   – Design control theory driven architecture level (GPGPU-Sim 3.0) power managements.
   – Enable high level power managements like DVFS and power gating collaboration with voltage stacking.

5. **Integrated Voltage Regulator (IVR) Modeling and Power Management [J2, C4]**   **(May 2016 - Present)**
   (Digital Circuit Design, Processor Power Management, CPU/GPU Architecture)
   – Model integrated voltage regulators (IVRs) such as buck, switched capacitor and LDO.
   – Develop open source IVR-enabled power delivery system modeling and simulation platform Ivory.
   – Design static and run-time managements for efficient and secure IVR-enabled power delivery.
   – Machine learning based IVR-enabled fast power management (DVFS) on CPU/GPU heterogeneous systems.

- **Research Assistant @ Control and Simulation Center**   **Harbin Institute of Technology**
  Research Area: high precision servo robot system   *Sep. 2012 - July 2015*

1. **- High Precision Angle Measurement System for Servo Robot [C6]**   **(Sep. 2012 - July 2015)**
   (PCB Circuit Design, Embedded System Programming, FPGA/DSP, Microcontroller, Robotics Control)
   – Design robot angle measuring systems on inductosyns and photoelectric encoders with 1/3600 degree resolution.
   – Design signal processing PCB boards with FPGA/CPLD communicating with upper computers through ISA/PCI.
   – Implement neural network based error compensation algorithm on DPS for robot angle measuring systems.
2. **- C++ Control Software for High Precision Servo Robot [C5]**   **(Sep. 2012 - July 2013)**
   (VC++ Commercial Software, Industrial Personal Computer, Robotics Control)
   – Develop Industrial Personal Computer (IPC) program for air bearing rotary stage and error automatically test system.
   – Program Delta Tau PMAC motion control board for servo motor control.

PUBLICATIONS

Journals:

J1. **An Zou**, Jing Li, Christopher D. Gill, Xuan Zhang. "RTGPU: Real-Time GPU Scheduling of Parallel Hard Deadline Tasks with Fine-Grain Utilization." *IEEE Transactions on Parallel and Distributed Systems 2019.* **(in preparation)**

J2. **An Zou**, Huifeng Zhu, Jingwen Leng, Xin He, Yazhou Zu, Christopher D. Gill, Vijay Janapa Reddi, Xuan Zhang. "Ivory 2.0: Early-Stage Design Space Exploration Tool for Integrated Voltage Regulators and Its Power Delivery System" *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems 2019.* **(in preparation)**.

J3. **(TCAD 2020) An Zou**, Jingwen Leng, Xin He, Yazhou Zu, Christopher D. Gill, Vijay Janapa Reddi, Xuan Zhang. "Voltage-Stacked Power Delivery Systems:Reliability, Efficiency, and Power Management." *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems 2020.*

Conferences:

C1. **(RTAS 2020)** Jinghao Sun, Jing Li, Zhishan Guo, **An Zou**, Xuan Zhang, Kunal Agrawal, Sanjoy Baruah. "Real-Time Scheduling upon a Host-Centric Acceleration Architecture with Data Offloading." *IEEE Real-Time and Embedded Technology and Applications Symposium. April 2020.* **(accepted)**.

C2. **(MICRO 2018) An Zou**, Jingwen Leng, Xin He, Yazhou Zu, Christopher D. Gill, Vijay Janapa Reddi, Xuan Zhang. "Voltage-stacked GPUs: A Control Theory Driven Cross-Layer Solution for Practical Voltage Stacking in GPUs." In *2018 51st Annual IEEE/ACM International Symposium on Microarchitecture,* pp. 390-402. IEEE, 2018.

C3. **(DAC 2018) An Zou**, Jingwen Leng, Xin He, Yazhou Zu, Vijay Janapa Reddi, Xuan Zhang. "Efficient and Reliable Power Delivery in Voltage-Stacked Manycore System with Hybrid Charge-Recycling Regulators." In *2018 55th ACM/ESDA/IEEE Design Automation Conference,* pp. 1-6. IEEE, 2018.

C4. **(DAC 2017 Best Paper Nominations) An Zou**, Jingwen Leng, Yazhou Zu, Tao Tong, Vijay Janapa Reddi, David Brooks, Gu-Yeon Wei, Xuan Zhang. "Ivory: Early-Stage Design Space Exploration Tool for Integrated Voltage Regulator." In *Proceedings of the 54th Annual Design Automation Conference,* p. 1. ACM, 2017.

C5. **(CCC 2014) An Zou**, Hui Zhao, Yehan Ma and Da Li. Analysis Calculation and Testing of Rotary Inductosyn Angle Measuring Errors." In *Proceedings of the 33rd Chinese Control Conference,* pp. 8091-8096. IEEE, 2014.

C6. **(WCICA 2014)** Da Li, Hui Zhao, Honglin Xue and **An Zou**. "The Design and Implementation of Universal Interface Circuit for Photoelectric Encoder." In *Proceeding of the 11th World Congress on Intelligent Control and Automation,* pp. 6006-6011. IEEE, 2014.

Honors and Awards

A. Richard Newton Young Student Fellow Award	*2017*
DAC Best Paper Nomination (first author)	*2017*
Graduate Fellowship The Ohio State University	*2015*
China National Scholarship	*2014*
The Second Price of National Postgraduate Mathematics Contest in Modeling (China)	*2014*
The First Level Graduate Student Scholarship	*2014,2013*
People Scholarship	*2013,2012,2011,2010*
Outstanding Student	*2012*
Meritorious Winner Prize of National College Mathematical Contest in Modeling (MCM, U.S.)	*2011*
88412 Scholarship	*2011*
Individual Scholarship	*2011*

Professional Service Activities

Design Automation Conference (DAC) External Reviewer	*2018,2019,2020*
Journal of Signal Processing Systems Reviewer	*2020*

Mentored students

Master students: *Adith Jagadish Boloor, Duhong Xu, Yunshen Huang*
Undergraduate students: *Feiyang Jin, Shadi Davari, Hayden Sierra, Shuhe Tian, Chenyang Wang*

Technical Skills

Over 7 years experiences in Computer Engineering: *CPU/GPU Architecture, Embedded System, Robotics, Machine Learning, Digital Circuit Design, High Level Synthesis, FPGA/DSP, Linux Operating System, Real-time OS Scheduling, CUDA Programming, PCB Circuit Design,*
Programming Languages: *C/C++ (7+ years); Verilog (5+ years); CUDA; Python; M language; Latex*
Software: *Cadence Tools; Synopsys Tools; CCS; Quartus2; Altium Designer; MATLAB*