

An Zou

Ph.D. Candidate (4th year)

Department of Electrical & Systems Engineering
Washington University in St. Louis

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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
 - Teaching Assistant 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. **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* 2019. (minor revision).

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

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

PROFESSIONAL SERVICE ACTIVITIES

<i>Design Automation Conference (DAC) External Reviewer</i>	2018,2019,2020
<i>Journal of Signal Processing System Reviewer</i>	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, 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*