

# HAO CHEN

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## RESEARCH INTERESTS

Electronic Design Automation, Physical Design, Logic Synthesis, Formal Methods, Combinatorial Optimization.

## EDUCATION

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|-------------------|---|
| 08/2019 – Present | <b>The University of Texas at Austin</b> , Austin, TX<br>Ph.D. Student in Electrical and Computer Engineering (GPA: 4.0/4.0)<br>Advisor: Dr. David Z. Pan |
| 09/2014 – 01/2019 | <b>National Taiwan University (NTU)</b> , Tapei, Taiwan<br>B.S.E. in Electrical Engineering (GPA: 3.75/4.0)   |

## WORK EXPERIENCE

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| 07/2017 – 08/2017 | <b>IC Compiler - RDL Routing Team, Synopsys Inc.</b> , Taipei, Taiwan<br>R&D Intern (Mentor: Kai-Shun Hu) <ul style="list-style-type: none"><li>- Proposed and implemented an algorithm on <i>Routing Pattern Optimization Improvement</i>; up to 93% of bend count reduction is achieved. The algorithm has been merged into the product code base.</li><li>- Proposed an algorithm on X-architecture Steiner-tree construction.</li></ul> |
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## RESEARCH EXPERIENCE

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| 08/2019 – Present | <b>UT Design Automation Laboratory (UTDA)</b> , UT ECE, Austin, TX<br>Graduate Research Assistant (Advisor: Dr. David Z. Pan) <ul style="list-style-type: none"><li>- Researched on the <b>Machine Generated Analog IC Layout System (MAGICAL)</b> project of the DARPA IDEA Program, mainly responsible for the routing engine. [C5, C4]</li><li>- Research on matching extraction for analog circuits with machine learning.</li><li>- Taped-out an ADC with state-of-the-art performance under TSMC 40nm technology with fully automatically generated layout.</li></ul>  |
| 09/2017 – 01/2019 | <b>Applied Logic and Computation Laboratory</b> , NTU EE, Taipei, Taiwan<br>Research Assistant (Advisor: Dr. Jie-Hong R. Jiang) <ul style="list-style-type: none"><li>- Researched on <i>Threshold Logic Synthesis and Optimization</i> for modern circuit design.</li><li>- Proposed threshold logic network interconnect optimization algorithm using an efficient threshold logic function representation data structure; up to 10% interconnection and 14% weight/threshold value reduction achieved over highly optimized threshold logic networks. [C3]</li></ul>  |
| 02/2017 – 01/2019 | <b>Electronic Design Automation Laboratory</b> , NTU EE, Taipei, Taiwan<br>Research Assistant (Advisor: Dr. Yao-Wen Chang) <ul style="list-style-type: none"><li>- Proposed an algorithm on <b>Obstacle-Aware On-Track Bus Routing</b> based on directed acyclic graph; outperformed the winning teams in the 2018 ICCAD Contest, where the top-3 routers result in 145%, 158%, 420% higher costs than ours. [J1, C2]</li><li>- Designed an algorithm on <b>Initial Detailed Routing</b>; in particular 23% reduction of routing cost was obtained compared with the first place router in the 2018 ISPD Contest. [C1]</li></ul> |

## PUBLICATIONS

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### Journal Articles

- [J3] **Hao Chen\***, Mingjie Liu\*, Xiyuan Tang\*, Keren Zhu\*, Nan Sun, and David Z. Pan, “Challenges and Opportunities Toward Fully Automated Analog Layout Design,” in *Journal of Semiconductors (JoS)*, 2020. (\* equal contribution) (Invited) (accepted)
- [J2] **Hao Chen\***, Mingjie Liu\*, Biying Xu\*, Keren Zhu\*, Xiyuan Tang, Shaolan Li, Yibo Lin, Nan Sun, and David Z. Pan, “**MAGICAL: An Open-Source Fully Automated Analog IC Layout System from Netlist to GDSII**,” in *IEEE Design and Test (D&T)*, 2020. (\* equal contribution) (Invited)
- [J1] Chen-Hao Hsu, Shao-Chun Hung, **Hao Chen**, Fan-Keng Sun, and Yao-Wen Chang, “**A DAG-Based Algorithm for Obstacle-Aware Topology-Matching On-Track Bus Routing**,” in *IEEE Trans. Computer-Aided Design of Integrated Circuits and Systems (TCAD)*, 2020.

### Conference Papers

- [C6] Keren Zhu, Mingjie Liu, **Hao Chen**, Zheng Zhao, and David Z. Pan, “Exploring Logic Optimizations with Reinforcement Learning and Graph Convolutional Network,” in *Proc. ACM/IEEE Workshop on Machine Learning for CAD (MLCAD)*, Virtual Event, USA, Nov. 16–20, 2020.
- [C5] **Hao Chen**, Keren Zhu, Mingjie Liu, Xiyuan Tang, Nan Sun, and David Z. Pan, “**Toward Silicon-Proven Detailed Routing for Analog and Mixed-Signal Circuits**,” in *Proc. IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, Virtual Event, USA, Nov. 2–5, 2020.
- [C4] Keren Zhu, **Hao Chen**, Mingjie Liu, Xiyuan Tang, Nan Sun, and David Z. Pan, “**Effective Analog/Mixed-Signal Circuit Placement Considering System Signal Flow**,” in *Proc. IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, Virtual Event, USA, Nov. 2–5, 2020. (Best Paper Award Nomination from track)
- [C3] **Hao Chen**, Shao-Chun Hung, and Jie-Hong R. Jiang, “**Disjoint-Support Decomposition and Extraction for Interconnect-Driven Threshold Logic Synthesis**,” in *Proc. ACM/IEEE Design Automation Conference (DAC)*, Las Vegas, NV, Jun. 2–6, 2019.
- [C2] Chen-Hao Hsu, Shao-Chun Hung, **Hao Chen**, Fan-Keng Sun, and Yao-Wen Chang, “**A DAG-Based Algorithm for Obstacle-Aware Topology-Matching On-Track Bus Routing**,” in *Proc. ACM/IEEE Design Automation Conference (DAC)*, Las Vegas, NV, Jun. 2–6, 2019.
- [C1] Fan-Keng Sun, **Hao Chen**, Ching-Yu Chen, Chen-Hao Hsu, and Yao-Wen Chang, “**A Multithreaded Initial Detailed Routing Algorithm Considering Global Routing Guides**,” in *Proc. IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, San Diego, CA, Nov. 5–8, 2018.

## HONORS & AWARDS

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2019, 2020	<b>Cockrell School of Engineering Fellowship</b> , The University of Texas at Austin.
2018, 2019	<b>Outstanding Performance Scholarship</b> , National Taiwan University.
2018	<b>3<sup>rd</sup> Place</b> , IEEE/ACM ICCAD CAD Contest - Problem A.
2018	<b>Top 10</b> , IEEE/ACM ICCAD CAD Contest - Problem B.
2018	<b>3<sup>rd</sup> Place</b> , ACM ISPD Initial Detailed Routing Contest.

## SKILLS

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Programming:	C/C++, Python, Java, Verilog, $\LaTeX$ , Linux System
EDA Tools:	Cadence Virtuoso, Cadence Innovus, Cadence ADE, Synopsys Hspice, Synopsys PrimeTime
Deep Learning Toolkits:	Pytorch, Tensorflow, Keras

## PROFESSIONAL SERVICES

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### Reviewer

- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD'20)