INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

AnGeL: Fully-Automated Analog Circuit Generator Using a Neural Network Assisted Semi-supervised Learning Approach

TECHNOLOGY NUMBER: 2024-061

OVERVIEW

Automated analog circuit design using a semi-supervised machine learning system

- Reduces labeled data needs and design time significantly, advancing circuit design automation
- Analog circuit design in electronics, automotive, telecommunications, and integrated circuit (IC) development

BACKGROUND

Designing analog circuits involves determining both the circuit topology and the precise parameters for individual components. Traditional methods require significant manual input and large labeled datasets to ensure comprehensive design space coverage, particularly with the growing complexity of circuit architectures. Historically, each circuit topology demanded a separate labeled dataset, causing inefficiencies, as previously gathered datasets became redundant with any alteration in topology. Supervised machine learning techniques, while accurate, have relied heavily on extensive labeled data, which is time-consuming and costly to obtain. These challenges highlight a pressing need for improved methodologies that streamline the design process while maintaining accuracy, allowing efficient exploration and optimization of the entire circuit design space.

INNOVATION

Researchers at the University of Michigan have developed, AnGeL, a semi-supervised learning methodology that leverages both labeled and unlabeled data, allowing the neural network to learn complex circuit behaviors by associating them with simpler topological structures. This approach drastically reduces the volume of required labeled data by up to 1090 times compared to existing state-of-the-art methods and significantly expedites the design process. By breaking down complex circuits into manageable sub-circuits and using neural networks for topology and sizing prediction, AnGeL facilitates high-accuracy designs across numerous topologies with minimal data input. As a result, AnGeL offers applications in automating the design process of a wide range of analog circuits, supporting rapid prototyping and deployment in sectors such as consumer electronics, telecommunications, and automotive industries.

ADDITIONAL INFORMATION

Technology ID

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Category

Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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REFERENCES

M. Fayazi, M. T. Taba, E. Afshari and R. Dreslinski, "AnGeL: Fully-Automated Analog Circuit Generator Using a Neural Network Assisted Semi-Supervised Learning Approach," in IEEE Transactions on Circuits and Systems I: Regular Papers, vol. 70, no. 11, pp. 4516-4529, Nov. 2023, doi: 10.1109/TCSI.2023.3295737

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