Kunming, China (Nov. 6, 2020)

Panel Session

The impact of AI to the technology world, mainly from device and design perspectives.

My Position Statement   Designer first, AI second.
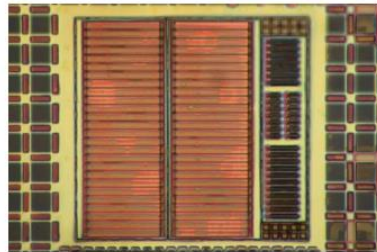
Haruo Kobayashi

Gunma University, Japan

My Position Statement

In viewpoint of analog circuit design and testing

● Cooperation between designer and AI
● Practical use of AI

Analog circuit →   physical
Not completely cyber → AI cannot be 100%.
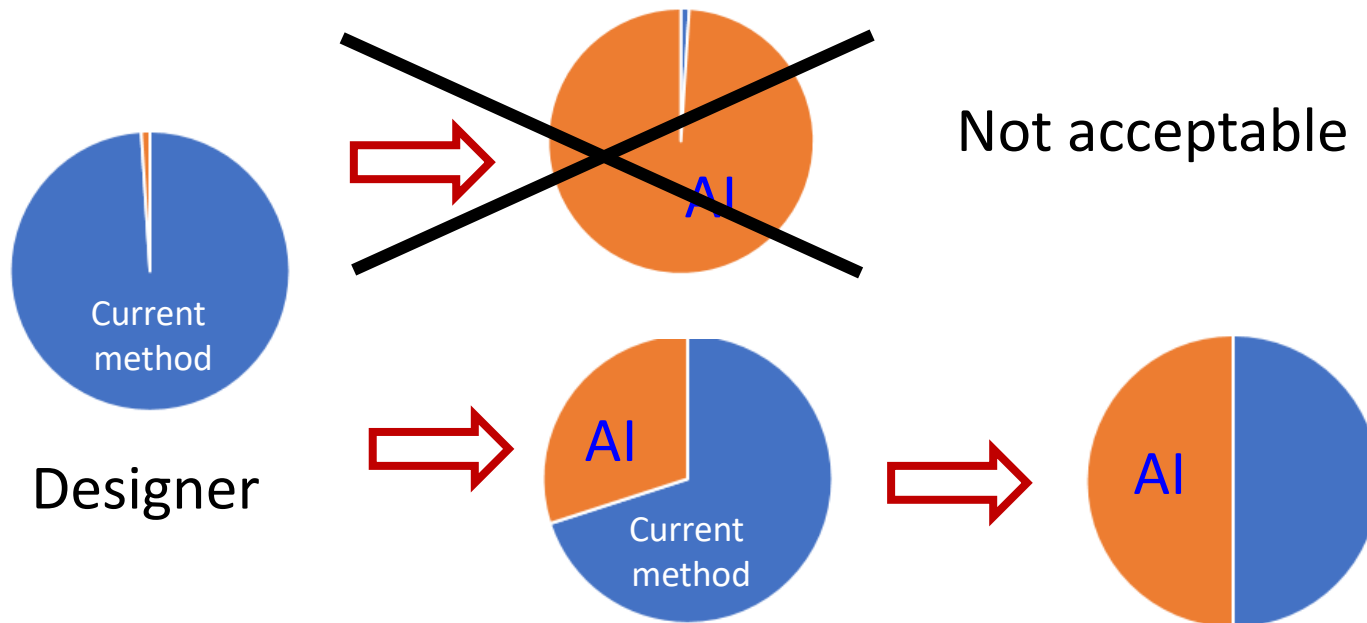

Analog IC

High reliability

A lot of know-how.

Industry cannot accept 100% different method.

Practical Use of AI is Important

- Computer science researchers
➡ A lot of difficult words (buzzwords).

- Electronics researchers often claim
➡ Nothing has been achieved when booming is over.

● Designer-oriented AI

Current method

Not acceptable

AI

Designer

AI

Current method

AI

What should we do ?

● Designer should be an excellent architect to consider
   - Designer's knowledge/experiences
   - EDA based on conventional algorithms
   - EDA based on AI
   - Others

Designer decide
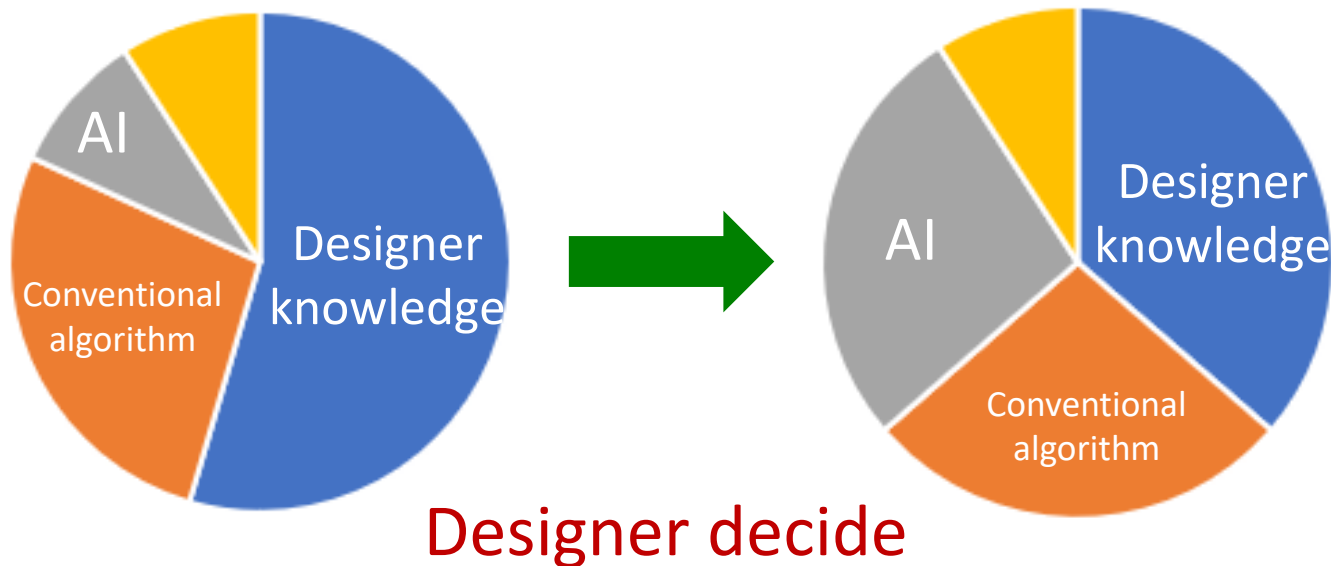
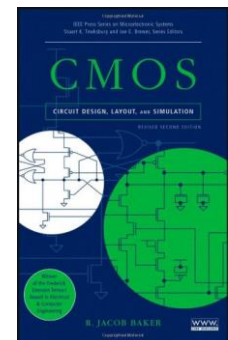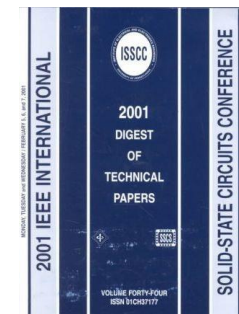# IC Design Supported by AI

● **IBM Watson System** (Medical Area)

- A lot of medical research papers.

-Medical doctor cannot read all of them.

- Watson system can identify the disease name and show its treatment immediately.

⇩ Apply

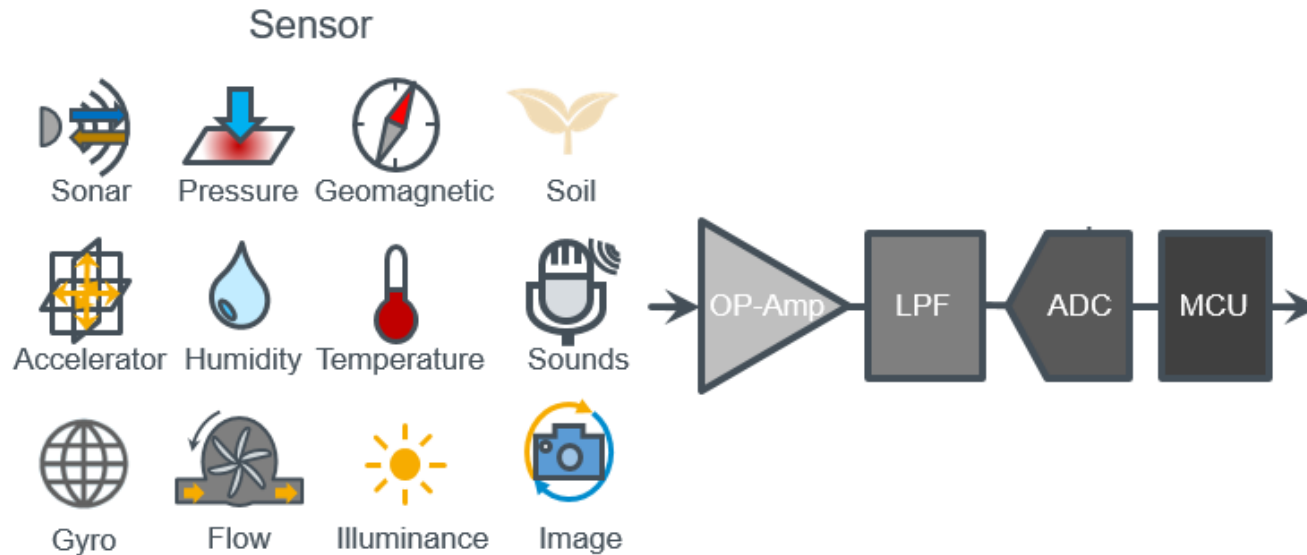IC design area

A lot of circuit design papers, text, patents,…

IoT System Design Supported by AI

● IoT system design with AI

Complicated system with a lot of sensors, analog interfaces, data storage and processors

AI might help optimum design of IoT system

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mainly from device and design perspectives.

Question (5)

How would major technology trends,
AI and IoT, would interact?

What would be their combined impact to our lives?

Dream of AI and IoT-Combined System

Future AI and IoT-combined system will solve

such a difficult problem as COVID-19:

 - collect useful information

    but with incomplete information

 - show how to make its vaccine

 - show when it is over

 - show optimal strategy to society and economy

Hope it can solve

 unexperienced and unpredictable problems.

Machine cannot learn from the past

AI and IoT-Combined System

By considering COVID-19 problem,

we might see

  - potentials, possibilities

  - technology limitation

of future AI and IoT-combined system.

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The impact of AI to the technology world,
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Question (10)

What new testing technique and methodology
would be needed
to support development of the AI chip?

Challenge of AI Chip Testing

● AI chip testing at mass production shipping
  - Based on customer demands
  - AI chip fast time-to-market
  - Balance of test quality and cost
  - Consider AI chip property

● Various AI Chips:
  Their effective testing methods
  - Depending on AI chip
  - In some cases, use conventional test method
    in others, develop new method individually

High Performance Digital AI Chip

Digital AI Chip with high processing ability

Processing power ➡ Twice every 3.5 months

- Consider its testing strategy
  from the beginning of AI chip design and layout
  for fast time-to-market

- Utilize AI chip property
  such as regularity of multi-processor cores

- Advanced device : Fin FET ➡ Own failure mode

Analog-related AI Chip

Ex. Computing-In-Memory as AI chip

● New memory devices ➡ test challenges
MRAM, ReRAM, FeRAM, PCM..
Many research papers in test conferences

● For consumer applications,
testing with digital automatic test equipment
(no analog option) for low cost test

Future Perspective

● Use all aspects of technologies

- Circuit technique

- Cooperation among BIST, BOST & ATE

　　　　as well as software & network

- Signal processing algorithm

- Use resources in SOC

　　such as μP core, memory, ADC/DAC

Aristotelēs
「学問無王道」

There is no science without measurement.

There is no production without test

No royal road to analog testing

H. Kobayashi, "Analog/Mixed-Signal Circuit Testing Technologies in IoT Era"
ICSICT, Session B2 Analog 2 (Nov. 4, 2020)

Future Perspective

⬤ Use all aspects of technologies
  - Circuit technique
  - Cooperation among BIST, BOST & ATE
        as well as software & network
  - Signal processing algorithm
  - Use resources in ~~SOC~~ AI Chip
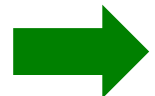   such as µP core, memory, ADC/DAC, AI core

Aristotelēs
「学問無王道」

There is no science without measurement.

There is no production without test

No royal road to analog testing

➡ A lot of AI chip testing research challenges

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AI can be everywhere in Testing

Example 1:

For PVT variation effect reduction

Self-Calibration in mixed-signal IC

Boundary between circuit design & test

Current: Adaptation algorithm

AI adopted: Learning algorithm

Example 2: Data compression technology in AI

Test time reduction, Defect saving

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