



NVIDIA and TSMC Bring AI Into Fabs to Advance Semiconductor Design and Manufacturing

News Summary:

- NVIDIA CUDA-X libraries and AI models are accelerating TSMC workloads across lithography, transistor and process simulation, advanced process control and fab operations optimization.
- TSMC is using NVIDIA Metropolis and NVIDIA TAO Toolkit to advance automated defect inspection with vision AI, improving detection of nanometer-scale defects while reducing repeated labeling and retraining.

NVIDIA GTC Taipei--NVIDIA today announced that TSMC, the world's leading semiconductor company, is using NVIDIA accelerated computing and AI to advance semiconductor design and manufacturing.

As chips move to more advanced nodes, bringing them from design to high-volume production has become one of the world's most complex computing challenges. Computational lithography, transistor simulation, process control and wafer inspection now require massive-scale simulation and real-time optimization, and AI systems that can provide support across physics, images and other applications.

TSMC is using NVIDIA technologies to accelerate this transformation, applying accelerated computing and AI across the [semiconductor design and manufacturing](#) lifecycle to improve turnaround time, energy efficiency, yield and operational productivity in advanced fabs.

"NVIDIA and TSMC have worked together for nearly three decades to push the limits of computing," said Jensen Huang, founder and CEO of NVIDIA. "TSMC is bringing NVIDIA AI and accelerated computing into the fab itself, tackling some of the world's most complex design and manufacturing challenges with simulation, optimization and AI to improve speed, efficiency and yield for the next generation of chips."

"TSMC and NVIDIA have built a long-standing partnership rooted in advancing the technologies that make the next generation of computing possible," said C.C. Wei, chairman and CEO of TSMC. "By using NVIDIA accelerated computing and AI across fab operations optimization, lithography, process control and inspection, TSMC is strengthening our technology leadership and manufacturing excellence to support our customers' future products and success."

TSMC Accelerates Processes With NVIDIA CUDA-X Libraries and AI

Advanced semiconductor design and manufacturing require massive computational workloads and highly coordinated fab operations, spanning chip-design transfer, transistor modeling, process control and fab productivity.

TSMC is using [NVIDIA CUDA-X](#)™ libraries and AI models to accelerate these workloads on NVIDIA GPUs:

- **Computational lithography:** TSMC is using [NVIDIA cuLitho](#), a GPU-accelerated library for lithography -- a printing method for chip mask design. This technology delivers a 20-50% improvement in cost effectiveness or cycle time compared with CPU-based computational lithography, while maintaining the same cost of ownership.
- **Transistor, equipment and process simulation:** TSMC is using [NVIDIA cuEST](#), a GPU-accelerated electronic structure simulation library for 50x faster chemistry simulations, on average, for semiconductor material design.
- **Advanced process control:** TSMC is using the [NVIDIA cuML](#) machine learning library to accelerate large-scale analytics on NVIDIA GPUs. This lets TSMC speed algorithms and distill hundreds of thousands of process parameters spanning thousands of steps as precision inputs for machine learning models -- making significant reduction in process variation.
- **Fab operations optimization:** GPU-accelerated scheduling computation using CUDA has led to notable improvements in fab productivity with [NVIDIA H200 GPUs](#). By harnessing CUDA-powered computation on NVIDIA H200 GPUs, TSMC has enhanced its capability to manage complex constraints, thereby streamlining production paths and maximizing fab productivity.

TSMC Advances Defect Inspection With NVIDIA Metropolis and AI Models

As chips become more advanced, even the smallest defects can affect quality and yield, making faster and more accurate inspection essential to semiconductor design and manufacturing.

TSMC is using the [NVIDIA Metropolis](#) platform and [NVIDIA TAO Toolkit](#) to improve advanced defect classification. Using vision AI, TSMC has improved detection of defects at nanometer scale.

These capabilities help TSMC improve quality inspection while reducing the need for repeated labeling and retraining as process conditions, inspection tools and defect types change.

TSMC Taps NVIDIA Omniverse to Build FabTwin

Advanced semiconductor fabs are among the most complex fabs ever built, requiring precise coordination across tools, materials, robots, humans and facility systems.

TSMC is exploring [NVIDIA Omniverse™](#) libraries to build FabTwin, a virtual fab environment for evaluating process tool layouts and related simulation workflows. By testing design scenarios digitally before physical implementation, TSMC can compare complex configurations more flexibly and identify potential constraints earlier. This virtual-first approach vastly improves planning efficiency and accelerates critical decision-making before any physical or capital commitments are made.

Watch Huang's [keynote](#) and learn more at [NVIDIA GTC Taipei](#).

About NVIDIA

[NVIDIA](#) (NASDAQ: NVDA) is the world leader in AI and accelerated computing.

Certain statements in this press release including, but not limited to, statements as to: TSMC bringing NVIDIA AI and accelerated computing into the fab itself, tackling some of the world's most complex design and manufacturing challenges with simulation, optimization and AI to improve speed, efficiency and yield for the next generation of chips; expectations with respect to growth, performance, availability, and benefits of NVIDIA's products, services and technologies, and related trends and drivers; expectations with respect to NVIDIA's third party arrangements, including with its collaborators and partners; expectations with respect to technology developments, and related trends and drivers; projected market growth and trends; expectations with respect to AI and related industries; and other statements that are not historical facts are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended, which are subject to the "safe harbor" created by those sections based on management's beliefs and assumptions and on information currently available to management and are subject to risks and uncertainties that could cause results to be materially different than expectations. Important factors that could cause actual results to differ materially include: global economic and political conditions; NVIDIA's reliance on third parties to manufacture, assemble, package and test NVIDIA's products; the impact of technological development and competition; development of new products and technologies or enhancements to NVIDIA's existing products and technologies; market acceptance of NVIDIA's products or NVIDIA's partners' products; design, manufacturing or software defects; changes in consumer preferences or demands; changes in industry standards and interfaces; unexpected loss of performance of NVIDIA's products or technologies when integrated into systems; NVIDIA's ability to realize the potential benefits of business investments or acquisitions; and changes in applicable laws and regulations, as well as other factors detailed from time to time in the most recent reports NVIDIA files with the Securities and Exchange Commission, or SEC, including, but not limited to, its Annual Report on Form 10-K and Quarterly Reports on Form 10-Q. Copies of reports filed with the SEC are posted on the company's website and are available from NVIDIA without charge. These forward-looking statements are not guarantees of future performance and speak only as of the date hereof, and, except as required by law, NVIDIA disclaims any obligation to update these forward-looking statements to reflect future events or circumstances.

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