

# SEMICON® EUROPA

NOV 15-18, 2022 | MUNICH, GERMANY



## Fab Management Forum

### Welcome Remarks



L. Altimime  
President  
SEMI Europe, Berlin, Germany



### Abstract

Welcome Note

### Biography

As President of SEMI Europe, Laith Altimime leads SEMI's activities in Europe and the Middle East and Africa (EMEA). Altimime has P&L responsibility as well as ownership of all Europe region programs and events, including SEMICON Europa. He is responsible for establishing industry Standards, advocacy, community development, expositions, and programs. He provides support and services to SEMI members worldwide that have supply chain interests in Europe. He manages and nurtures relationships with SEMI members in the region and globally as well as with local associations and constituents in industry, government, and academia.

Altimime has more than 30 years of international experience in the semiconductor industry. Prior to joining SEMI in 2015, He held senior leadership positions at NEC, KLA-Tencor, Infineon, Qimonda and imec. Altimime holds an MSc from Heriot-Watt University, Scotland.

## Opening Remarks



M. von Podewils  
Director MEMS & Erfurt Operations  
X-fab, Erfurt, Germany



## Abstract

Non applicable

## Biography

Mario von Podewils has more than 40 years of experience in microelectronics manufacturing. In 1982, he started his career as a maintenance technician for various types of semiconductor manufacturing equipment in the microelectronics industry in Erfurt, Germany. After obtaining his degree in electronics engineering, he spent several years as a team leader responsible for equipment maintenance in various process areas in wafer fabrication at Thesys GmbH, Erfurt.

From 1992 to 2001, he was project manager of national and international joint projects in the semiconductor industry, mainly funded by the BMBF or the EU.

In 2001, he obtained his diploma in industrial engineering, specialising in operations and production management. Since then, he has held various positions as department and module manager for equipment engineering and the lithography module at X-FAB Semiconductor Foundries AG, among others.

In 2007, he took over the position of Fab Operations Manager at X-FAB Semiconductor Foundries GmbH in Erfurt.

At the beginning of 2021, he was delegated to the MEMS site in Itzehoe of the XFAB Group as Site Manager. Since autumn 2022, as Director MEMS & Erfurt Operations, he is now responsible for both wafer fabs at the Erfurt and Itzehoe sites as well as X-FAB's global MEMS production.

## Frontier of Challenge and Opportunity: Semiconductor Shortages, Geopolitics, & Outlooks



D. Hutcheson  
Vice Chair  
TechInsights Inc., Greenwood Village, United  
States of America



### Abstract

2020 was a pivotal year in world history that brought unprecedented challenges and opportunities. COVID threw a curveball at the semiconductor industry: decoupling it from the economic cycle, elevating the perception of its importance to economy in the minds of world leaders, as it rang the death knell for globalization. This presentation examines how COVID led to the Great Semiconductor Shortage of 2021, as business leaders reacted to 2020's early events in ways that left them unprepared to deal with what came after. There would be an unprecedented rise in demand as the human toll of the virus came to a close only to be left with a ravaged supply chain that could not adequately respond to this demand. It lays out how this unraveled the auto industry's ability to produce cars as it coped with a shortage of critical chips. Like dominos, COVID tipped the block to knock into the Great Chip Shortage in 2021, which then tipped to knock globalization down. The geopolitics driving a perceived need for national technology sovereignty is examined as it delves into how it started in China in the mid-2010s and was locked in with the Taiwan hyper-coherence issue of the early 2020s.

### Biography

Dan is Vice Chair of TechInsights Inc. He is a recognized authority on the semiconductor industry, winning SEMI's Sales and Marketing Excellence Award<sup>[1]</sup> in 2012 for "empowering executives with tremendous strategic and tactical marketing value" through his e-letter, *The Chip Insider*®; his book *Maxims of Hi-Tech*, and his many interviews of executives.

As some industry leaders have said, "He is the marketing voice and expert for the industry." "Dan has methodically captured the essence of the industry and produced it in such a way for all to benefit ... He has been such an integral part of the industry for so long, it is difficult to imagine the industry without his contributions."

Dan's public work on the industry has often focused on challenging predictions of the demise of Moore's Law that date back decades by demonstrating how doomsayers have been outpaced by emergent behavior through the innate ability of technologists to innovate. This has included invited articles for *Scientific American*, the *SIA*, and the Plenary at the *SPIE Advanced Lithography Conference*.

[1] Formerly SEMI's Bob Graham Award

## Next Generation Manufacturing



M. Alexander  
Partner  
Roland Berger, Munich, Germany



### Abstract

For decades now, manufacturing companies have been under tremendous pressure to keep their costs down, quality up, and margins defended. By and large, they were successful. By adopting lean thinking and other optimization methodologies, by integrating automation and outsourcing parts, components, and sometimes entire products to factories located in lower-cost markets, they delivered. However, these levers have reached their limits and are turning out not to be sufficient any more.

Today, there are a number of trends shaping manufacturing that have reached a tipping point:

**Sustainability, industry disruption, regionalization, populism, individualization, and digitalization.**

Given this new perspective, the view of manufacturing "competitiveness" **changes from mainly a cost focus (labor, material) to a much broader view** where factors like CO2 emissions, green energy, complexity of the supply chain, flexibility, or dependency play a much bigger role.

Our talk is divided into five parts:

**First**, we look at the desperation that so many manufacturers feel about the future of manufacturing.

**Second**, we consider each of the six trends and what they mean for manufacturing companies.

**Third**, we introduce the Regional NGM Benchmark, a tool that will show you at a glance the relevance of each of the six trends in the world's most important manufacturing markets.

**Fourth**, we look at why the six trends should be seen as an opportunity for manufacturers rather than a thread.

**Fifth**, we suggest what you can do to begin your journey toward becoming a Next Generation Manufacturer.

In summary, we see a window of opportunity for manufacturers rather than a thread. We show how each of these trends may constitute one of the great chances of our time for forward-looking companies. Those who take decisive action can rethink & reconfigure their operations and turn their manufacturing once again into a true value generator.

### Biography

Dr. Michael Alexander - Partner Advanced Technology Center Industrial Platform, Roland Berger

Dr. Michael Alexander joined Roland Berger in 2014 as a Partner in our Industrial platform. He is an industry expert in the electronics and semiconductor business and founded Roland Berger's Advanced Technology Center. His recent consulting work has centered on strategy, business development and R&D management, with a special focus on electronic component industries. He has carried out successful projects for international electronics, semiconductor, renewables and machinery groups in Europe, Japan, Southeast Asia and the US.

Michael brings more than 15 years of management experience in Europe and Asia to Roland Berger. He holds several Advisory Board seats in the B2B industry and science community. He also spent five years with another large international consultancy.

Prior to his work in industry and consulting, he pursued an academic career at the Max-Planck-Institute of Solid State Research and as a Post-Doc at the Industrial Research Institute (IRI) in Yokohama, Japan. In 1991, he received the "Young Scientist Award" from the Werner-von-Siemens-Ring Foundation. Michael holds a Master's degree in Physics from the University of Munich (LMU) and a PhD from the University of Stuttgart in Semiconductor Physics. Prior to his academic education he also received vocational training in banking.

## Opening Remarks by Session Chair



J. Recklies  
Senior Vice President  
Infineon Technologies AG, IFAG FE R,  
Regensburg, Germany



### Abstract

No Content

### Biography

**Joerg Recklies** has been in the semiconductor industry for 27 years with responsibilities ranging from Chip design to IDM. He is currently in charge of the General Manager at Infineon Technologies Regensburg. Prior to that, Joerg Recklies was in charge of the FAB Manager at Infineon Dresden and held several positions in automation and productions at Infineon. These positions contributed to his excellent experience in terms of equipment and automation. Earlier in his carrier he has made contributions in digital and analog Chip design. Joerg Recklies holds a graduate engineer for Semiconductor.

#### Highlight during the time with Infineon ....

- Establish high automation at IFD 1995- 1997 as project leader automation software integration
- Project Leader world wide cost reduction program within Infineon Frontend Productions from 1999 –2003 (within Europe, US, Asia)
- Section Manager Plasma Etch / Wafer Inspection 2003- 2007
- Director Maintenance Engineering 2007 – 2014
- Project Leader 300 mm Fab Startup / Transfer Power Technologies 2011-2013
- FAB Manager Senior Director 200 / 300 mm Dresden 2014 – 2018
- General Manager Site Regensburg Senior Vice President since 2018

## Electrification for EVs



R. Bornefeld  
Senior Vice President Power Semiconductors &  
Modules  
Robert Bosch GmbH, Reutlingen, Germany



### Abstract

Coming Soon

### Biography

Ralf Bornefeld is Senior Vice President with responsibility for business line and engineering of Power Semiconductors & Modules at Bosch. He joined Bosch in November 2019.

Before he held various management positions at Infineon Technologies AG: senior director technology in frontend production from 2005-2008, senior director engineering of automotive sensors until 2011 and finally vice president and general manager business line automotive sensors.

Ralf started his career at Elmos Semiconductor in 1992 as a technology development engineer. Afterwards he took several management positions until end of 2004, mostly serving as vice president of R&D and eventually as vice president of business line microsystems.

Ralf Bornefeld was born in Schalksmuehle, Germany, in 1964. He graduated with a degree in Electrical Engineering from Technical University of Dortmund in 1992.

## Joint Risk Management Paves the Way to Sustainable Supply Chains & Innovation



A. Aal  
Semiconductor Strategy & Reliability  
Volkswagen, Munich, Germany



### Abstract

The necessary automotive transformation creates challenges and opportunities that cannot be addressed by only setting ecological targets. It is mandatory to set up a plan under given and dynamically changing economical and geo-strategical constraints.

Since the beginning of the pandemic and its supply shortage after-wave combined with previously not sufficiently risk assessed geo-strategical “impacts”, we all have lessons learned while part allocation task forces running day-by-day in parallel occupying a lot of resources and costs in addition to shortage originating not sold goods. This situation creates a lot of uncertainty about which directions to take and decisions / investments to make (risk function) along the supply chain, because company internal risk management processes remain internal while information from the “outside” world (input signal) is biased (not sufficiently aligned).

This is all coming on top of transformation created supply challenges in the automotive industry like battery efficiency being depended on needed raw materials in a global supply chain, limited manufacturing capacity for power electronics whose capacity increase is slowed down by the semiconductor shortage affecting fabrication tool availability plus the not yet achieved electronic architecture switch away from uncountable ECU variant implementations.

While cyber security is considered as “the” challenge of the electronics industry for the running decade, supply related root-of-trust processes will become even more mandatory – however, current risk management approaches are limited and supply issues will tend to last ... until new collaboration models are jointly build, agreed and running.

### Biography

Andreas (IEEE SM / CRP) drove the semiconductor strategy & reliability assurance activities within the E/E development at Volkswagen, Germany, for many years, concentrating on technology capability enhancement of most advanced nodes incl. improved HW integration schemes as well as optimization of power electronics for automotive applications. He temporarily joint CARIAD SE between 2020 and 2022 as system architect and product security officer with focus on semiconductor and SW driven innovations.

Wearing always one shoe from the semiconductor industry and the other one from the car OEM, he became a strong representative of the through-the-supply-chain-joint-development and collaboration approach also being rewarded with the EDA Achievement award 2020.

He has 24 years of experience with and within the semiconductor industry, has authored/co-authored over 40 publications on reliability and has given tutorials at IEEE IRPS and IIRW as well as invited and keynote speeches during various conferences and conventions.

His early collaboration activities began already in 2007 becoming the chair of the German VDE ITG group MN 5.6 on (f)WLR, reliability simulations and qualification. He is currently also chair of the European chapter of the SEMI Global Automotive Advisory Council (GAAC), member of the coordination team of the corresponding “European platform for automotive semiconductor requirements along the supply chain”

hosted by the VDE ITG and member of the Bmbf industry advisory board on cyber security.

Driving the disruptive automotive transformation process on a collaborative supply chain basis is one of his major passions.



## How medical devices are changing the customer-foundry relationship



R. Tillner  
CEO  
X-FAB Dresden, Dresden, Germany



### Abstract

Over the last years the medical industry was pushing for more automation to improve time to result and cost. The Covid pandemic has given another push in this direction.

Automotive driven foundries are the perfect partner for the medical industry as they are used to long qualification times and even longer product lifecycles which are also needed in the medical business. Medical and life science applications also require functionalities which cannot be bought out of the shelf. Designer and foundry partners need to develop a close partnership to create a successful product for these markets.

Life science companies like MaxWell Biosystems are designing such unique chips for very dedicated use cases. The CMOS-based microelectrode arrays of MaxWell Biosystems are integrating 26'400 platinum microelectrodes in an array, using a MEMS process. These electrodes are used to pick-up the minute signals of neurons, cultured directly on top of the microelectrode array. Together with the use of induced pluripotent stem cells this enables an unprecedented access to human disease models in a dish for drug discovery in the pharmaceutical industry, increasing the potential success of new medicines for neurodegenerative diseases.

X-FAB as pure play foundry has developed unique skills to support customers like MaxWell Biosystems, no matter if they are startup companies or big players in their markets.

### Biography

Rico Tillner has 15 years of experience in the semiconductor industry. After his master's degree in electrical engineering at Technical University Dresden he started his career at X-FAB Dresden. From 2007 until 2015 he worked as Process integration engineer, responsible for a 0.6µm automotive mixed signal technology. During that time, he gathered experience in quality methods, yield improvement projects and the conversion from a 6-inch to an 8-inch production. In 2016 he becomes the quality manager of X-Fab Dresden. Since 2018 Rico Tillner is the site manager and CEO of X-FAB in Dresden.

### Co-presenter Urs Frey

Urs Frey received the diploma in electrical engineering from ETH Zurich, Switzerland, in 2003 and the Ph.D. degree for his work on high-density neural interfaces and microhotplate gas sensors from the Physical Electronics Laboratory, ETH Zurich, in 2008. From 2009 to 2010, he was with IBM Research Zurich, Switzerland, where he worked on mixed-signal circuit design for non-volatile memory devices. In 2011 he joined the RIKEN Quantitative Biology Center in Kobe, Japan, where he was heading an independent laboratory focusing on CMOS-based bioelectronics and biosensors. In 2016, he co-founded MaxWell Biosystems AG in Switzerland, where he is currently the CEO.



D. Hutcheson  
Vice Chair  
TechInsights Inc., Greenwood Village, United  
States of America



### **Biography**

Dan is Vice Chair of TechInsights Inc. He is a recognized authority on the semiconductor industry, winning SEMI's Sales and Marketing Excellence Award<sup>[1]</sup> in 2012 for "empowering executives with tremendous strategic and tactical marketing value" through his e-letter, *The Chip Insider*®; his book *Maxims of Hi-Tech*, and his many interviews of executives.

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[1] Formerly SEMI's Bob Graham Award

## Panel Discussion – Navigating through global developments affecting the supply chain management



A. Kohnen  
CEO  
time:matters GmbH, Neu-Isenburg, Germany

**time:matters**

### Abstract

10:30 - Panel Discussion – Navigating through global developments affecting the supply chain management

How can we enable improvements in supply chain?

Supply chain changes / access to x (materials, tools, etc e.g. lead time to tools) / Supply chain management post covid / new relationships / how can we help our suppliers to faster delivery

how to scale material supply/capacity exponentially

Global development on supply-customer relationship based on covid-era lessons learnt

Tool usage beyond expectancy (legacy tools) in fabs, what will it happen in these technologies in a few years (sustainability aspect)?

Moderator: Dan Hutchinson, CEO and Chairman, VLSI

### Biography

Alexander Kohnen is CEO and Managing Director Strategy and Sales for time:matters Holding GmbH in Neu-Isenburg. As an expert in high-performance and worldwide special speed logistics and in time-critical international spare parts logistics, time:matters provides tailor-made and fast solutions for particularly urgent and complex logistical tasks. Besides speed and reliability, providing an individual, flexible service is paramount.

Alexander Kohnen began his career in 2000 as Information Manager Sales & Marketing with Lufthansa Cargo AG in Frankfurt am Main. In his 17 years with Lufthansa Cargo, he gained extensive management experience in various leadership roles at home and abroad, including a period from 2008 as Country Manager Sales and Handling Benelux in Amsterdam. He moved to Stockholm in 2011 to take up the role of Director Sales and Handling Nordics & Baltics, covering sales, marketing and commercial management in Scandinavia. Before his switch to time:matters, he was most recently Senior Director with responsibility for the Industry Development & Product Management division at Lufthansa Cargo in Frankfurt.

In November 2017, Alexander Kohnen joined the management team at time:matters. The company finished that same year with a 55% year-on-year increase in revenue and registered tremendous growth in the automotive and high-tech/semicon focus industries. Under Alexander Kohnen's leadership, time:matters has added another 17 stations (Tel Aviv, Mexico and 15 stations in the US) to its unique Sameday Air network for same-day transports. The logistics company has also been awarded ISO 14001:2015 environmental management certification. By acquiring CB Customs Broker and Customs Broker Cargo Handling, time:matters has been able to extensively expand its customs clearance and handling portfolio. In the coming year, with Alexander Kohnen at its helm, the company is again planning countless internationalization projects, further digitization of its offering, connection of customer and partner systems via APIs and further development of its time:matters airmates On Board Courier platform.

time:matters is now considered one of the leading providers of flexible special speed solutions. The internationally renowned logistics specialist has already been operating extremely successfully in the sector since 2002, which has been continuously reflected in its positive revenue trend. In 2017 time:matters concluded with 108 million euros in revenue.

The native of Cologne trained as a commercial air transport apprentice with Lufthansa AG in Frankfurt, before going on to complete a Business Administration degree. Alexander Kohnen is married and has three children.



## Welcome Remarks



B. Weiss  
Chief of Staff & Corporate Strategy  
SEMI, Milpitas, United States of America



## Abstract

Welcome Remarks

## Biography

As Chief of Staff & Corporate Strategy, Bettina Weiss reports to SEMI's President & CEO and manages a broad portfolio of responsibilities. Major focus areas include advancing specific global strategic initiatives such as SEMI's Smart Mobility and Supply Chain initiatives and SEMI University, facilitate thought leadership (Think Tanks) activities in key strategic areas as well as improving organizational efficiency, alignment and financial sustainability. In addition, Weiss is the Sr. Liaison to the SEMI Board of Industry Leaders, leading strategic partnerships and M&A activity, and supporting the President & CEO in successfully creating a highly effective, agile global association.

Weiss joined SEMI in 1996 and held a variety of positions in SEMI's International Standards department, including department lead, global responsibility for SEMI's Photovoltaic/Solar Business Unit, business development including the integration of SEMI Strategic Association Partners FlexTech, MEMS & Sensors Industry Group, ESD Alliance and the SOI Consortium.

Prior to joining SEMI, Weiss worked in sales and marketing positions at Metron Semiconductor and Varian Semiconductor in Munich, Germany. She holds a BA from the International School for Applied Languages in Munich, Germany, and is a certified translator for Anglo-American Law and Economics.

## Opening Remarks



K. Schimpf  
Fab Manager  
Texas Instruments, Ffab, Freising, Germany



## Abstract

Not available

## Biography

now 25 years with TI

- 1997: Phd in Physics Research Centre Juelich
- 1997: joining TI in Freising as Product engineer working on Development and yield improvement of Analog technologies
- 2007-2020: various mgmt roles in Engineering and Operations
- 2021: Fab Manager , FFAB TI Freising

## **Jailhouse: Mixed Criticality Systems for Semiconductor Manufacturing**

R. Ramsauer  
Head of Research Group  
Technical University of Applied Sciences  
Regensburg, Regensburg, Germany

### **Abstract**

The advent of multi-core CPUs in nearly all embedded markets has prompted an architectural trend towards combining safety critical and uncritical software on single hardware units. We present an architecture for mixed-criticality systems based on Linux that allows for the consolidation critical and uncritical parts onto a single hardware unit. In the context of the iDev 4.0 project, the use-case of this technological building block is to reduce the overall amount of distributed computational hardware components across semiconductor assembly lines in fabs. CPU virtualisation extensions enable strict and static partitioning of hardware by direct assignment of resources, which allows us to boot additional operating systems or bare metal applications running aside Linux. The hypervisor Jailhouse is at the core of the architecture and ensures that the resulting domains may serve workloads of different criticality and can not interfere in an unintended way. This retains Linux's feature-richness in uncritical parts, while frugal safety and real-time critical applications execute in isolated domains. Architectural simplicity is a central aspect of our approach and a precondition for reliable implementability and successful certification. In this work, we present our envisioned base system architecture, and elaborate implications on the transition from existing legacy systems to a consolidated environment.

### **Biography**

Ralf Ramsauer is a postdoctoral researcher at the Technical University of Applied Sciences Regensburg where he leads the Systems Architecture Research Group. His academic research interest focuses on mixed- and safety-critical systems, real-time embedded systems and embedded virtualisation on various architectures. This covers the full software stack of embedded systems, from hardware-related low-level virtualisation technologies via kernel-space up to userland. Ralf is a codeveloper of the Linux-based statically partitioning hypervisor Jailhouse, where he currently works on the RISC-V port.

# How to Simplify Engineers' life in Complex Semiconductor Manufacturing - About Democratization of Information and its Usage in Production Scheduling and Root Cause Analysis



P. Roßbach  
Analytics Solution Engineer EIA  
SYSTEMA, Dresden, Germany



## Abstract

Digitalization keeps driving increased demand for microchips. Shortening the product lifecycle and the high variety of customer-specific devices lead to a growing need for high-mix low-volume (HMLV) semiconductor production. SYSTEMA drives several activities to achieve a novel quality in production control and explainability of how the fab behaves. The “Autonomous Integrated Scheduling for Semiconductor Industry” (AISSI) project partners with Bosch, Nexperia, Simlab, KIT. Goal is to apply AI-based methods to enable autonomous production scheduling. However, such AI-solutions are “black boxes”. They will only be accepted, if users understand the system: “explainability”– see also the EU "General Data Protection Regulation GDPR".

Objective is simplifying engineer's work and hand-over a powerful framework for continuous and rapid learning - and maybe creating a smile.

SYSTEMA created a semantically inspired holistic information model (HIM). This offers, for the first time, an easily understandable access and method to close the gap between huge amount of data and the need to analyze this data in real-time, while offering at the same time the possibility to create formerly unseen, personalized “insights”. The solution concept implements a single point of truth (SPOT) approach, enabling best algorithmic efficiency at the same time. Complex WHAT-IF-Analysis is enabled:

- What are the root causes of those dynamically appearing “WIP bubbles”
- Did the efficiency of the entire production line sustainably improved when the new scheduling method was introduced?

Additionally, counter-factual analysis is enabled – which is critical to enable human learning. The aim is to create an informational 'play space' that is fundamental to human imagination.

AI-based methodologies seem to provide important capabilities in order to solve the complex planning task of production or the "job scheduling problem". SYSTEMA has analyzed the requirements together with Nexperia and created a new AI-based scheduling concept utilizing 4M-methodology. Detailed analysis accomplished are, e.g., setup- and occupancy planning of batching machines (furnaces), maintenance and shift activities and many others.

*Examples highlighted during poster session and presentation will touch a “counterfactual” improvement of an entire production area (such as furnace) and showing its influence on the entire fab;  
a dive-in into an integrated AI-based scheduling method.*

## Biography

### Philipp Roßbach (Speaker)

holds a M.Sc. in Applied Informatics – Data Science from HTW Dresden, University Applied Science (Germany). He started in 2015 at SYSTEMA for his B.Sc., and later during his M.Sc., and supported his first projects for semiconductor manufacturing. Currently, he is 1) contributing to the R&D program AISSI at SYSTEMA while 2) also researching at HTW for Cell-based analysis in systems medicine.

For AISSI, (“Autonomous Integrated Scheduling for Semiconductor Industry”) Philipp helps to develop, integrate and apply novel AI-based approaches in semiconductor manufacturing that builds on European quality-thinking from the automotive sector.



For HTW, his fields of research are data-driven modeling for the analysis of multicellular tissue organization and model-based prediction of an Effective Adhesion Parameter guiding multi-type cell segregation.

**Dr. Gerhard Luhn (Mentor)**

holds a Ph.D in engineering science from the University of Erlangen-Nuremberg (Germany). He has more than 25 years of experience in semiconductor manufacturing and information science. Currently, he is heading an innovation program at SYSTEMA GmbH together with the Technical University of Dresden and several major renowned industry partners, which aims at the industrial proof, prototypical and scientific validation of a new, mathematically grounded method of causal-holistic information processing. Gerhard previously worked as team leader / program manager and research fellow for Infineon/Dresden, Technical University Dresden and Siemens/Munich. He also held various positions in France with Siemens / IBM joint venture in Essonnes; and ST Microelectronics in Crolles. Gerhard holds a patent application, authors scientific papers, and engages in the science of information.

## LineLab, an Analytical Tool for Modeling Semiconductor Manufacturing Systems



L. Nietner  
Cofounder  
Massachusetts Institute of Technology (MIT),  
Cambridge, United States of America

LineLab<sup>+</sup>

### Abstract

Semiconductor production systems have traditionally been difficult to model and optimize. Nonlinear queueing behavior and tools handling dozens of processes introduce great complexity to the dynamics of variation and inventory in a fab. As a result, only Monte-Carlo methods, like discrete-event simulation, could capture the relationships between capacity, queueing, utilization, inventory, and throughput that govern operations and performance. Since any simulation run only offers a single-point solution, optimizing a fab for a new device often requires months of simulation.

We have developed an analytical method that captures these complex system dynamics, and are commercializing it in a new software tool called LineLab. The first true alternative to Monte-Carlo simulation for modeling complex fab systems, it enables a breadth of new analyses and significantly accelerates the development timeline.

To create LineLab's powerful solver, we developed prescriptive analytics for queueing systems, and are using an optimization technique that is capable of handling the nonlinear relationships, alongside detailed financial models. For fabs of any complexity, LineLab can optimize capacity, buffers and utilization of each high-value tool, work-in-progress inventory and flow time / cycle time, minimizing total unit cost. LineLab considers the cost of inventory as it optimizes queue sizes, accounting for wafers' value-add with every process. Our approach can capture any level of flow complexity, including re-routing wafers through the same tool many times with intermediate steps, inbound flows and quality, capturing the effects of process time variability. It can also capture the interaction of parallel product flows and determine the effective cost of adding a new product to a shared system in a foundry.

With our analytical approach, the complete sensitivity data for every input are known at all times. Coupled with the ability to specify inputs with uncertainty, LineLab reveals the key performance drivers and risks across the entire system encompassing design, process models, and fab operations. LineLab can determine the marginal cost of variability, design parameters, and any other input.

The approach also allows for parametric models capturing Scope 1 & 2 CO<sub>2</sub>, water usage and other sustainability metrics.

An MIT spinout, LineLab is the first tool to optimize complex queueing systems, and it captures their dynamics with a very high degree of accuracy (>99%).

### Biography

Dr. Larissa Nietner is cofounder of LineLab, a spin-out from MIT. She received her Masters and Ph.D. in Mechanical Engineering from the Massachusetts Institute of Technology (MIT) after obtaining a B.Eng. in her native Germany. Dr. Nietner has presented at the Flex Conference (now part of SEMI) and given a number of invited talks at universities in the US and Europe. After completing her Ph.D., she held a postdoctoral position at MIT's Sloan School of Management in the Operations Research Group joining Dr. Scott Nill, where she worked on the new modeling framework that makes up LineLab. Together, they spun out LineLab, releasing the launch version of the software in 2021, and continue to co-author peer-reviewed papers about the approach and the far-reaching new analyses it enables.

## Machine Learning for Automated Image Classification in Yield Enhancement



V. K. Thomas  
Intern  
Texas Instruments, Yield Enhancement, Freising,  
Germany



### Abstract

One of the most repetitive and time-consuming tasks for our operation specialists in the Yield Enhancement group is the manual image classification. Moreover, due to stress and environmental conditions the consistency and accuracy of the manual classification varies. Therefore, we have been looking for a fully automated solution to relieve our specialists from the tedious classification tasks. In addition, the implementation of the solution to our production flow and integration to our fab automation has a positive impact on productivity.

We have explored various options available for our pilot automated classification project and found Convolutional Neural Networks (CNN) can produce consistent and accurate results for one specific classification task. We use a generally accepted CNN classification model trained on thousands of images from the scanning electron microscope. Since the input image dataset was highly biased, we used Image augmentation techniques to improve the results. In addition, we have also considered techniques like Transfer Learning to scale our solution to other image classification tasks. Our current model outperforms in terms of consistency and accuracy when compared to the manual classification.

We will achieve more by integrating fab automation to the automated image classification. A successful completion of the classification tasks triggers the fab automation to check whether to logout the lot, to inspect more wafer from the same lot or to put the lot on hold. With a fully automated fab process, we can minimize delays and waiting times of wafers. So far, we have been successful in implementing and integrating automated image classification with fab automation as a pilot project. We have identified a high fan out potential of this automated classification method and will be working to transfer the promising results to other areas as well.

### Biography

Vipin holds a bachelor degree in Computer Science and Engineering from Mahatma Gandhi University, India (2013). He has worked for about 4 years in various companies (2014 - 2019) and gained knowledge on diverse technologies and frameworks such as mainframes, angular framework, data analysis with Python, cloud and Data Science/ML frameworks. Since Oct 2020, he is pursuing a MSc. Applied Computer Science at TH Deggendorf with expected graduation in Apr 2023. Currently, he is working at Texas Instruments as an Intern (Mar 2022 - Aug 2022). He is interested in Data Science projects and Edge AI.

## Opening Remarks



S. Alba  
AG300 Fab - CVD and Dry Etch Area Manager  
STMicroelectronics, Agrate Brianza, Italy



## Abstract

Not available

## Biography

Simone Alba has more than 25 years of experience in the semiconductor industry. He got his master's degree in Physics with specialization in Plasma Physics at University of Milan. After few years spent in the field of plasmas for space applications, he joined STMicroelectronics at Agrate Brianza site (Italy). Holding various managerial roles, he had the opportunity to develop a wide technical experience in technology nodes (350-32nm), technology devices (Flash Memories, Phase Change Memories, Embedded Memories, BCD, ...), manufacturing environments (from early R&D to high volume manufacturing). He also had the chance to deal with different company cultures and businesses thanks to strategic projects, technology transfers, benchmark, etc. At present he is CVD/dry etch area manager in the new 300 mm fab in Agrate.

## **Infineon and Lam Research: Machine Learning will Change the Way We Work - A Collaboration to use Big Data Analysis and Regression Modeling to improve Fab Productivity and to Lower Manufacturing Costs**



A. Fros  
Director  
Infineon Technologies AG, Regensburg, Germany



### **Abstract**

Infineon views Artificial Intelligence/Machine Learning (AI/ML) as the foundation to the development of novel techniques leading to improved product performance and fab stability, whilst at the same time being a key driver of competitiveness. AI empowers the engineer to focus less on data acquisition and more on the analysis. When this is coupled with experience acquired in the fab, real opportunities to increase stability, increase yield, and lower costs become apparent to engineers in ways they did not before. AI can reduce the burden of decision-making in the fab when predicted outcomes are consistent with actual outcomes. In this context, the cost and productivity challenges posed by metrology in the fab environment clearly present an opportunity for improvement.

This presentation describes the collaboration between Infineon and Lam Research to improve costs and efficiency of the etch rate qualification and reports the results achieved.

Equipment Intelligence® data analysis (EI-DA) is a proprietary advanced multivariate big data analysis system developed by Lam Research. EI-DA polls the entire sensor matrix on Lam 2300® platforms, distilling large quantities of data through dimension reduction techniques. A novel approach, so called 'virtual metrology', leverages EI-DA, to seek process specific statistical parameters which best map 'in process' performance to on-wafer results in an accurate and repeatable way. Employing the principles of ML, the predictive models are periodically fed real on wafer data ('y-data'), to validate the results. Through further extension of this method, Lam and Infineon have demonstrated consistent performance of the models when applied to the more cost effective 'bare silicon' wafers. This enables lower material cost, reduced utilization of metrology tools, and higher fab productivity.

Predictive model fitting of  $R^2 \approx 0.87$ , ( $RMSE \approx 0.5$ ) has been demonstrated, which is consistent with real on wafer data. The model reliability offers Infineon the option to selectively replace conventional metrology operations with virtual metrology. Additionally, the method allows a metrological result to be predicted with a high degree of confidence for every wafer. Much of the decision-making process becomes automated. Solutions are arrived at earlier. Such successful applications of AI/ML enable better approaches to how we work today, and into the future, in line with the Infineon vision of "Being part of today, Being part of tomorrow".

### **Biography**

Agnes Fros has 12 years of experience in the semiconductor industry. After her degree in Industrial Engineering for physical technologies at the University of Münster, Agnes joined Infineon Regensburg where she completed the certified Innovation Manager program at Sensorik Cluster. In the Frontend divisions she has held many roles including Performance Controller, Industrial Engineer, Defect Density Engineer and Process Integration Engineer for HF products. Under her leadership of the Wafer Inspection and automated Optical Outgoing Inspection departments, superior quality for all products processed was delivered. Since 2020 Agnes Fros is Director of the Plasmaetch Department for Frontend Production, responsible for both

process engineering and the maintenance of an extensive fleet of Fab tools. By applying novel AI techniques to the existing fab knowledge base in Infineon, Agnes Fros is leading an effort to automate decision making processes in the fab for better and more consistent outcomes.

**Co-presenter**

Ottaviano Zechini, Sr, Director, Europe Equipment Intelligence Leader, Lam Equipment Intelligence Zechini holds a masters degree in Electronic Engineering and has more than 25 years' experience in the semiconductor business, working for leading equipment manufacturers such as GaSronics, Novellus Systems and Lam Research, starting from Operations Management, moving to Sales Management and then to Account General Management. He joined Lam Research in 2015 as a Site GM based in Dresden, to then be appointed as Central Europe Account GM in 2017. Since January 2022, he has been leading the Lam Equipment Intelligence® activities within the European Region.

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## Step Into the Future: Unparalleled Efficiency Gains with the Next-Generation Optimization-Based Platform (Real Use Cases).



J. Potter  
Co-founder and CEO  
Flexciton Ltd, London, United Kingdom



### Abstract

As advancements in chip design accelerate, a major barrier to progress is the sheer complexity of chip production. A typical wafer fabrication process can entail hundreds of steps, generating more manufacturing options than there are atoms in the universe. To unlock the full potential of fabs, a new kind of intelligent technology is required to replace the complexity with effortless, optimized decision-making.

Flexciton's next-generation optimizer can simplify and streamline production, ensuring substantial efficiency gains are achieved. During our session, we will share real use cases and results achieved by applying the solution in different facilities and to different areas of a fab, such as photolithography and diffusion.

### Biography

Jamie is an expert in mathematics and statistics and graduated at the top of his year from the University of Oxford. He is passionate about solving the hardest industrial problems. An entrepreneur at heart and by choice. Jamie co-founded Flexciton in 2016 after spending a few years working in a consultancy developing optimization solutions for industrial applications. At Flexciton, along with his role as the CEO, he leads the commercial and operations teams. In 2018, Jamie was featured in Forbes' 30 under 30 list.

## No Fear of High Dynamics in Fab Core Design



S. Kummer  
Chief Executive Officer  
SHK Engineering and Consulting GmbH & Co. KG,  
Dresden, Germany



### Abstract

The basis for planning a Fab has always been and will always be very dynamic. Changing equipment layouts and equipment configurations while a fab is being built is given fact in every Fab start-up project.

New workflows and tools help to deliver good design results on time, even with this high level of dynamism. “Design competitions”, “digital twins” and the “single source of truth approach” are three success factors that will be presented with specific examples.

Join this session and learn about the honest insights of Semiconductor fab core engineering and why to walk not on a beaten track became a key success factor for high quality engineering with speed and efficiency that was not thought to be possible before.

### Biography

Sebastian Kummer is an engineer who designs semiconductor fab with passion.

He got first insights in the semiconductor industry as Hitachi trainee in Japan. In his role as equipment engineer he was part of the first 200mm Fab start-up in Europe.

Sebastian founded his own engineering and consulting firm and discovered early the power of software and electronic data to make engineering more efficient and better.

He worked so far in 17 large 200mm and 300mm Frontend Fab start-up projects from construction start until after “Ready For Equipment” and in total in 33 High-Tech projects. He spent a large portion of his business life onsite in Japan, Europe, Malaysia, Taiwan and the U.S.A. and learned here about the different cultures of design, engineering and construction.

In responsible roles from industrial- to facility- and hook-up engineering in projects for Siemens, Motorola, Micron, Infineon Technologies, GlobalFoundries, Nanya Technology, X-Fab and ams Osram he designed the elements inside the Fab core from automation-, equipment and subfab layouts to process laterals and hook-up.

Sebastian Kummer is owner and Chief Executive Officer of SHK Engineering and Consulting.

He earned his degree as graduated engineer at the University of Applied Sciences in Munich. Sebastian lives south of Munich and likes to spend his free time in the mountains. He is married and has three children.



## The Digital Transformation of Semiconductor Manufacturing



J. Behnke  
General Manager FPS  
INFICON, Dresden, Germany



### Abstract

Coming Soon

### Biography

Mr. Behnke has more than 35 years of semiconductor industry experience including: logic and memory manufacturing, technology/product development and fab operational excellence. As the GM of Final Phase Systems an INFICON Product Line, John leads a team that develop and deploy SMART software solutions that enable fabs to improve their manufacturing efficiency. FPS's suite of software solutions are built upon a common Datawarehouse which enables advanced Fab Scheduling and optimized WIP movement as well as other related capabilities. He is also a Co-Chair of the Semi North America Smart Manufacturing Special Interest Group.

Prior to FPS John served as the CEO and President of Novati Technologies, the SVP and GM of the Semiconductor Group of Intermolecular, the CVP for Front End Manufacturing, Process R&D and Technology Transfers at Spansion and the Director of AMD's Fab 25's Engineering and Operations groups where he was a founding member of AMD's Automated Precision Manufacturing (APM) initiative which led the Semiconductor industry's development and use of APC and other advanced factory systems. He also led the successful conversion of Fab 25 from Logic to Flash memory which was enabled through the virtual automation of the fab.

Mr. Behnke earned a B.S. degree in Mechanical Engineering with an Industrial Engineering Minor from Marquette University. Mr. Behnke holds five U.S. patents.

## AR/VR - Metaverse :Virtual Reality for Mental & Physical health in B2B



C. M. Gnerlich  
CEO  
brainjo GmbH, Startup, Regensburg, Germany



### Abstract

AR/VR | Metaverse | Virtual Reality for mental & physical health in B2B | Brain Computer Interfaces | silicon valley accelerator participant | Seed Stage Startup

### Biography

CEO | Co-Founder

brainjo

June 2018-Today - 4 years 5 months

Software engineer (project related)

Coleida Ltd.

Feb. 2019-May 2019 - 4 months

Manager brainboost Amberg

Brainboost

Oct. 2017-Nov. 2018 - 1 year 2 months

Co-Founder in the Exist funded startup Herzheim.

Federal Ministry for Economic Affairs and Energy

2017-July 2017 - 7 months Jan.

Founder

Out of the Box Foundation (for ADHD).

2016-2017 - 1 year 2016-2017 - 1 year

Student Assistant | Institute for Sustainability in Technology and EconomicsS.

OTH Amberg-WeidenOTH

March 2016-Sept. 2016 - 7 months

Initiator | Students for Refugees Amberg-Weiden

OTH Amberg-WeidenJan. 2015-2016 - 1 year 1 month

### Awards

BCI Hackathon IEEE Brain BR41N.IO Prize 2020

From: g.tec neurotechnology Austria - Jan. 2020

Hackathon Regensburg (Winner)  
From: Hackaburg Regensburg - Jan. 2019

Competition: hospital of the future (winner)  
From: Medical Valley - Jan. 2017

Award for ethics and sustainability  
From: East Bavarian Technical University Amberg-Weiden - Jan. 2016

## The Pareto Principle in Industry 4.0



C. Hörr  
Carl Zeiss Digital Innovation GmbH, Dresden,  
Germany



### Abstract

More than ten years after the term has been coined, the idea of Industry 4.0 is finally about to lose its mysteries. Although its disruptive potential is widely accepted nowadays, the digital transformation of the shopfloors takes place much slower than originally expected. We summarize a few key learnings and typical impediments from current practice and discuss how to overcome them by applying the Pareto principle.

### Biography

Dr Christian Hörr has been working as a delivery lead at ZEISS Digital Innovation since July 2021 and consolidates the development activities surrounding Industry 4.0. He uses his practical experience gained over a decade as a full-stack developer and head of development in the field of optical measurement technology, robotics and automation technology.

## Smart Manufacturing in the Subfab



A. Serapiglia  
Business Development Manager  
Edwards Vacuum, Burgess Hill, United Kingdom



### Abstract

Fab utilization is at record highs. In addition, CSR and sustainability priorities are growing and customers are seeking more initiatives to increase their productivity while simultaneously reducing their environmental impact. Critical subsystem systems like vacuum and abatement in clean room and subfab have so far not been fully considered when optimizing manufacturing efficiency. This is changing.

In the presentation we will discuss and illustrate components of "Smart Manufacturing" and methods Edwards deploys to provide long-range maintenance guidance and maintenance prioritization, thereby reducing risk and uncertainty associated with unscheduled equipment downs. All that will be demonstrated on a real example of a fab, providing measures of improved chamber uptime and thus productivity.

### Biography

Antonio Serapiglia has more than 24 years of experience in the semiconductor industry. He held multiple process integration and optimisation roles in different parts of the world.