Fab Management Forum

Market Trends

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

Abstract
Coming soon

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^[1] 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

How medical devices are changing the customer-foundry relationship

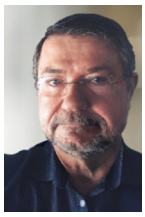
R. Tillner
CEO
X-fab, Dresden, Germany

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.



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

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

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.

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
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 creatig 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

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_2, 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 out 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.

Jailhouse: Mixed Criticality Systems for Semicondutor 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 accross 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.

The people challenge: How to overcome the skill shortage in the FAB´s?

H. Schoder
Vice President Human Resources
X-FAB Group, Dresden, Germany

Abstract
In the light of Europe's ambition to reinforce the semiconductor ecosystem in the EU with announcement of the Chips Act and significant planned investments into the semiconductor industry, the key to success has be and will be the ability to attract and keep the people required to run a fab. On the level of technicians we already see a substantial shortage in skills and people, and with the new stimulation package that shortage will become a major obstacle for growth ambition in the industry. The presentation will cover some important initiatives and ideas to tackle the problems particular in the are of Manufacturing.

Biography
Since 2014, Henryk Schoder has been overseeing the global HR activities for the X-FAB Group as VP Human Resources. Prior to joining X-FAB, Henryk was HR & IT Manager at Masdar's solar manufacturing plant in Germany. Before that he worked as Senior Consultant and Managing director for the MRL Consulting Group in the UK, Singapore and Dubai. He started his career as recruiting manager at Infineon. Henryk holds a Master degree in Psychology from the University of Jena, Germany.

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 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.

Improving productivity by using data 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.