

Advanced Optimization Technologies for Complex Manufacturing Operations can perfection on time delivery

Liola Technologies Ltd.
WHITEPAPER
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Liola developed a technology, product and go to market breakthrough that enables semiconductor manufacturing, Fab or Fabless operations and electronics components to optimize their production or operations plans and achieve dramatically increased efficiency and costs savings while perfecting on time delivery-OTD .

Introduction

A typical semiconductor operation (Fab or Fabless) or electronics components are extremely expensive and complex operations, manufacturing hundreds of different products and may run up to 100,000 units in the production line at any single point in time and across multiple facilities. With such a huge investment from one hand and the financial opportunity on the other hand, manufacturers are always looking for ways to optimize their production and planning to increase throughput. However, the extreme complexity of these production lines and their specific characteristics have been challenging optimization solutions for over a decade with limited progress in recent years. Liola has developed a revolutionary suite of software tools that brings the solution to this challenge.

Revolutionary Optimization Technology

The optimization of a semiconductor or electronics components operation is an exponential mathematical problem. Analyzing all the different paths would take more days than the number of atoms in the universe. Due to the intractability of this combinatorial problem, all existing solutions are based on constrained heuristic rules that can only deliver sub-optimal results due to its simplistic approach.

Liola's Exponential product is based on a breakthrough in optimization algorithms that combine a new mathematical approach with deep domain knowledge and specific characteristics of semiconductor production lines. The algorithms take into account the re-entrant and/or complex nature of the semiconductor manufacturing and electronics components assembly process and the inherent competition for resources. They deliver truly optimization, finding an optimal solution, yet without attempting to run through all possible paths.

Leveraging this unique technology and a team's 100 years of combined experience in the relevant industries, Liola's product delivers an additional breakthrough in the form of Optimization on Demand. This groundbreaking architecture enables, for the first time, the optimization of production on a daily basis to deal with changing conditions in near real time.

Liola's Manufacturing Optimizer Suite Offerings

*Liola offers a comprehensive suite of products that altogether provides a complete solution for: **Long term Work Planning and Scheduling, On-Line Simulation, and Daily Management of the production line**, as follow:*

- **Optimal Production Planning and Scheduling (PIVOT)** - performs true optimized production plans, *months ahead*
- **Line Operation Simulation (SANE)** – Performs the plans simulation at any time to get ready for future needs, *weeks ahead*
- **Daily Shift Planning (PLOT)** - performs **full production line planning** (vs. local planning), looking at various stations upstream and downstream to create the optimal operation daily plans for the entire manufacturing line, *days ahead*
- **True line performance parameters(PDB)** – *Performs true evaluations of lines performance parameters based on historical data*

With Liola products the operation will no longer be running Synthetic Simulations and Complex Semi-accurate models. With Liola Product suite you can apply the most advanced optimizations on your real time, real factory data, deriving line management goals and actions.

Products Application

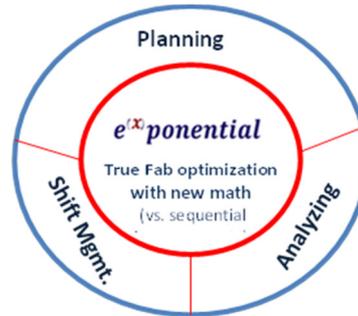
The new tools improves line efficiency, which is the top issue in modern complex production lines, characterized by multi-step re-entrant or/and competing for resources processes, multi-product operations, long overall cycle-times, very costly and/or diverse raw materials and manufacturing tools, and – last but not least – fast changing demands and requirements. Under these conditions, even slight improvements in line efficiency can result in significant revenue enhancements. In this framework, the ability to effectively accommodate new demands within current commitments, and readily present a reliable estimate of supply time for all orders, is the key to increase sales, improve customer satisfaction, cut operational cost and reduce dead inventory. The sensitive analysis-tool would empower planners and managers, at both corporate and plant environments, resolve complex manufacturing scenarios and to test, compare and verify possible changes – expected or

proposed – in line parameters or strategic envelope. The advanced line-management tool would enhance productivity with no additional resources.

The most prominent examples of complex production lines are those that operate in factories that manufacture computer chips (FABs) or perform systems assembly. However, many of the main issues resolved with Liola's tools apply to numerous diverse manufacturing operations as well.

To improve the effectiveness of a production line or supply chain, it is mandatory to explore, in appropriate detail, the vast variety of aspects and parameters that govern the line. This must be done at three different levels and for distinct purposes: Planning Level, Analyzing Level and Daily Management Level.

Each one of these levels applying to a different level of data granularity.



- **Planning and Scheduling**
 - Provides an optimized plan month ahead
 - Recommended product mix for optimized production
 - Fast accommodation of orders, demands forecast and capacity
- **Analyzing**
 - Best predict supply, WIP and line performance based on simulation weeks ahead
 - Highly flexible “what if” scenario setting
 - Simulation of long list variety of scenarios
- **Daily/Shift Management**
 - Optimized detailed, Shifty based run, line management plan few shifts ahead
 - Best supply prediction and goals setting based on detailed simulation and optimization
 - Optimized production plan based on current WIP, tool status & capabilities, orders
 - Satisfying line segment-goals by inter-segment flows
- **PDB - Production Data Base (in evaluation)**
 - Realistic predictions of production parameters based on historical line images

Liola Technology Advantages

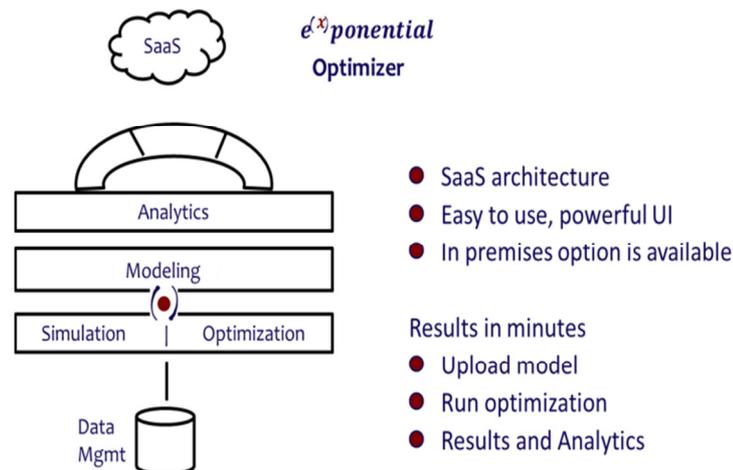
Liola developed a technology, product and go to market breakthrough that enables semiconductor manufacturing and electronics components assemblies to optimize their production plans and achieve dramatically increased plant throughput and dramatically improves operations on time delivery based on the following list of advantages:

Differentiation and Innovation

1. **Advanced Mathematical Methods:** Liola's *Exponential* product is based on a *breakthrough in optimization algorithms* that combine a new mathematical approach with deep domain knowledge and specific characteristics of semiconductors or electronics components production lines. The proposed tools are based on **advanced mathematical methods** rather than intuitive – but simplistic - thumb rules. They enable the user – at diverse levels of the industry – to generate fast and effective responses to dynamically varying demands or to changes in production resources, to evaluate long-term effects of alternative production policies, as well as to allocate resources at daily planning and to enhance efficiency of dispatching and assignment of material to tools. All these are aimed at strengthening competitiveness by increasing profit margin and market share.
2. **True optimization based on a different mathematical approach vs. existing goal seek sequential improvement methods**
 - a- Liola mathematical algorithm delivers truly *global optimization*, finding an optimal solution, yet without attempting to run through all possible paths. This is the result of over 25 years of (mostly unpublished) research in applied mathematics theory and specific algorithms for the domain of operations optimization.
 - b- The solution found by Liola's mathematics can be proven to be the global optimum, which means that there is no better solution. In contrast, all existing tools are based on goal seeking, which means sequential improvement.

These tools may only lead to local optimum. With Liola's mathematics, the difference in resources utilization, line throughput and/or cost reduction is dramatic.

3. **Complex Production lines Solutions.** The **Exponential Manufacturing Optimizer** is a new comprehensive family of software tools is presented, which effectively addresses the entire scope of complex production lines and supply chains, covering the phases of scheduling, planning, analyzing and managing of the line.
4. **Cloud based Service:** In addition, the products are sold in a unique, groundbreaking model of **Optimization as a Service (OaaS)**, which delivers for the first time **SaaS optimization** to this market. Instead of selling expensive and complex software systems like is being done by most competitors, Liola sells Optimization Runs of the system over the internet. Customers may start by purchasing a single run, which acts as a paid trial of the system (POC). At implementation level Liola can be implemented in SaaS mode or for customers that will like to acquire the product, Liola provides an on-premises solution as well. Using this approach, Liola has successfully implemented its product in leading semiconductor corporations.
5. **Revolutionary System Architecture Advanced offerings:**
 - Liola tools perform automatic data update and download without the need for manual data handling and downloading
 - To operate Liola tools there is no need to build unique system for new online data or output reports
 - Uniquely in the market, Liola products can be implemented and operated without the need of an expert team.
 - Liola tools setups are fast and do not required time consuming re-modeling to check different scenarios (new orders, cancellations, equipment capacity, etc.) .
 - Liola Installation and Training will last less than 24 hours.
 - By running in cloud mode, Liola products can be run in parallel, without affecting the std. line operation.
 - With Liola tools, immediate *operation line efficiency improvement- Saving millions of dollars in the operation.*



Summary

Liola harnesses advanced scientific and technical methods to streamline the core operations of complex manufacturing industries. With Liola products, companies can generate effective production plans and react to dynamic demands or operational events in very short response times. Thus a company would manufacture the right amount of each product, improve OTD and enhance customer satisfaction, reduce operational cost, and increase sales. Tools and results will be demonstrated.

For additional information or demo, please contact: PauaG@liola-tech.com or visit our Web page Liola-Tech.com