SMART PRODUCTION SYSTEMS LLC

Five-day course:

SMART PRODUCTION SYSTEMS

Offered by SPS LLC

Course goals:

- Introduce the attendees to the main concepts and software of Smart Production Systems (SPS)
- Provide the knowledge and hands-on experience necessary for managing production systems in the SPS environment.
- Provide the ability to participate in the design and deployment of SPS and to serve as SPS champions in manufacturing organizations.

Intended audience: Managerial and engineering personnel at large, mid-size, and small manufacturing organizations.

Prerequisites: None.

Course organization:

- Each of the five days consists of two sessions: morning (from 9 am to 12 noon) and afternoon (from 1 pm to 4 pm).
- Each session includes three periods of 50 min with 10 min breaks in between.

Course resources:

- Textbook: S.M. Meerkov, P. Alavian, and L. Zhang, *Smart Production Systems*, Best Seller Publishing, 2025. This book will be provided to all course participants.
- Website: www.SmartProductionSystems.com

Course instructors: S.M. Meerkov, P. Alavian, L. Zhang

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Course project:

The project is the main part of this course. It is intended to develop expertise for designing continuous improvement projects using either PSE Toolbox or PMA technology. While some of the design steps are technology-independent, the others are technology-dependent and, thus, different in PSE Toolbox-assisted and PMA-enabled approaches. All of the steps are briefly described below.

Step 1: Select a production system of interest for the project (technology-independent)
Step 2: Derive a mathematical model of the selected system; this is the most difficult, consequential, and time-consuming part of the project (technology-independent)
Step 3: Define equipment parameters to be measured on the factory floor to populate the mathematical model (technology-independent)
Step 4: Evaluate the performance metrics of the selected system using its mathematical model (technology-dependent)
Step 5: Formulate improvement goal(s) (technology-independent)
Step 6: Formulate scenarios for the desired improvement, i.e., define the performance metric(s) to be improved and a range of equipment modifications available to attain the goal(s) (technology-independent)
Step 7: Calculate continuous improvement projects corresponding to each of the scenarios introduced (technology-dependent)
Step 8: Select one of them for "implementation" (technology-independent)
Step 9: Analyze the system's performance if it were implemented on the factory floor (technology-dependent)

The technology-dependent steps will demonstrate the advantages and disadvantages of the two approaches: Namely, PSE Toolbox-assisted approach requires human intelligence to carry out the main design steps, while PMA-enabled approach automates these steps and, thus, can be carried out by managerial personnel without training in PSE or analytics in general. On the other hand, the PMA-enabled approach typically is more difficult to implement in practice and, thus, the PSE Toolbox approach may be used as a precursor to the decision-making automation based on PMA.

The class participants will carry out these projects either individually or in teams of 2-3 members. The instructors will be available to assist with system selection and in all other steps of the projects.

In some cases, a project may require complete versions of PMA and PSE Toolbox (rather than the demos available at www.SmartProductionSystems.com). In these cases, upon request, the team will be provided with PMA and PSE Toolbox as SaaS free of charge.

Course Syllabus:

DAY 1:

Morning session:

- Smart Production Systems
- Programmable Manufacturing Advisor
- Relationship of PMA-based SPS with Industry 4.0
- Foundation of PMA Analytics and Software: Production Systems Engineering and PSE-Toolbox
- Preview: A Brief Demonstration of SPS Operation

- Hands-on exercises: Familiarize yourself with PSE Toolbox and PMA demos (available on the course website under the PRODUCTS tab) and use them for "design" of improvement projects (based on example-systems included in the demos).

Afternoon session:

- Production Systems Types
- Machine and Buffer Parameters
- Evaluating Machine Parameters using Factory Floor Measurements
- Production Systems Performance Metrics
- Evaluating Induced Accuracy of Analytically Calculated Performance Metrics

- Course project: Carry out Step 1.

DAY 2:

Morning session:

- Mathematical Modeling of Production Systems
    - Structural Model
    - Parametric Model
    - Model Validation
- Examples of Mathematical Modeling
    - Automotive Transmission Case Machining Line
    - Electronic Board Production System
    - Automotive Ignition Control Module Assembly System
    - Automotive Underbody Assembly System

- Course project: Carry out Step 2.

Afternoon session:

- Fundamentals of Production Systems Engineering
    - PSE General Characterization
    - PSE Analytics for Performance Metrics Evaluation
    - PSE Analytics for Management Concepts
        - Bottleneck machine
        - Intermittent bottleneck machine
        - Bottleneck buffer
        - Buffering potency
        - Quality bottleneck
        - Closed lines impediment
        - Production lead time analysis and control
        - Lean buffering
        - Product-mix performance portrait of multi-job production systems
        - Qualitative Laws of Production Systems

- Hands-on experience: Explore the above Management Concepts using PSE Toolbox and PMA (based on Example system 1.0 provided along with the demos).
- Course project: Continue working on Step 2 and carry out Step 3.

DAY 3:

Morning session:

- PSE Toolbox and PSE Toolbox-assisted Performance Analysis
    - PSE Toolbox Homepage
    - Illustration of PSE Toolbox Operation
    - Production Systems Performance Analysis using PSE Toolbox

Course project: Carry out Step 4 using PSE Toolbox

Afternoon session:

- PSE Toolbox-assisted Design of Continuous Improvement Projects
    - Procedure for PSE Toolbox-assisted Design of Continuous Improvement Projects
    - Examples of PSE Toolbox-assisted Design of Continuous Improvement Projects

Course project: Carry out Steps 5-9 using PSE Toolbox

DAY 4:

Morning session:

- PMA and PMA-based SPS Architectures
- PMA-based SPS Modes of Operation, Regimes, and Data Structures
- PMA-based SPS Homepage and Workflow
- Illustration of PMA-based SPS Operation
- PMA and PMA-enabled Design of Continuous Improvement Projects
    - Procedure for PMA-enabled Design of Continuous Improvement Projects
    - Examples of PMA-enabled Design of Continuous Improvement Projects

- Course project: Carry out Step 4 using PMA

Afternoon session:

- Procedure for PMA-enabled Design of Continuous Improvement Projects
- Examples of PMA-enabled Design of Continuous Improvement Projects

- Course project: Carry out Steps 5-9 using PMA

DAY 5:

Morning session:

- Preparation of viewgraphs for projects presentations

Afternoon session:

- Projects presentations

Upon successful completion of this course, the attendees will receive a Certificate of SPS Training.

 Updated 2/14/2025