
Research Seminar (Hauptseminar) in Summer Term 2024

Algorithms and Methods for Assembly Line Balancing and Job Shop Scheduling Problems

Hinweis für Studierende deutscher Masterprogramme (Note for Students of German Master's Programs)

Das Hauptseminar richtet sich sowohl an englisch- als auch an deutschsprachige Studierende (Master MW, WI, WIW, IBE). Die Sprache der Hausarbeit kann vom Studierenden frei gewählt werden (Englisch oder Deutsch). Die Zwischen- und Abschlusspräsentationen (inkl. Diskussion) erfolgen ausschließlich in englischer Sprache.

Brief Description and Objectives

Assembly line production and job shop production are two different asset arrangements for manufacturing.

In assembly line production, products move through the production system in a continuous flow. The assets are arranged in the sequence of the production steps for a specific product type, i.e. it is an object-oriented arrangement. Production usually takes place in large quantities and in a highly standardized way. For example, assembly line production is often applied in the automotive industry.

In job shop production, machines are grouped by function or process into workshops. The arrangement is thus process-oriented. Production is more flexible and well suited for customized products or smaller production quantities. This type of arrangement is often preferred when specialized machinery or manufacturing processes are required.

Both process flow structures rely on a coordinated production planning to ensure efficiency. Numerous more or less strict assumptions are imposed for either the classical assembly line balancing problem or the classical job shop scheduling problem. But only the fewest real production systems fulfill all of these assumptions. This is why various algorithms and methods with relaxed assumptions have been developed in research in recent years.

The individual papers of the research seminar should take a closer look at these new extended algorithms and methods. The aim is to elaborate the basic statements and special features of the formal models in detail and to examine their applicability and utility.

In addition to this in-depth study of asset arrangement problems, which are only superficially considered in the group's lectures, the research seminar is also intended to further train the skills of the students in writing scientific papers and thus serve as preparation for the Master's thesis.

Organizational Notes

Prerequisites for participation: Bachelor's degree in an Economics or Management program is mandatory. Previous participation in the lecture Supply Chain and Closed Loop Management is recommended.

Limitation of participants: A maximum of 15 students from the Master's degree programs Medienwirtschaft, Wirtschaftsinformatik, Wirtschaftsingenieurwesen or International Business Economics.

Enrollment: Registration can be done via an online form. The link will be published on the group's homepage in due course. There you will also find general information on the course of the seminar. Please note: When registering, you can indicate a total of three topic preferences.

Formal notes on the preparation of the seminar paper: Although some topics are assigned to several students, each student must write an own and individual paper (length of the paper: 14–16 pages, incl. illustrations, excl. cover sheet, lists, appendix, ...) focusing on individually selected aspects. In order to avoid inappropriate overlaps between papers, the content must be agreed with the supervisor. The group reserves the right to delete certain topics after registration, although the interests of the students will be considered. The assignment of topics as well as tips and information on formalities and the basics of scientific writing will be announced at the kick-off event.

Preliminary Dates

Participation in **all** events is **compulsory!** Even one absence without a valid reason will lead to exclusion from the seminar!

Date	Time	Location	Content
25.03.24, 7 a.m. – 10.04.24, 7 a.m.	all day	online	enrollment/registration
Thursday, 11.04.2024	01:30 p.m. – 02:30 p.m.	Oec, room 2007	kick-off event* (general introduction to seminar topic and topic assignment)
Wednesday, 08.05.2024	01:30 p.m. – 04:30 p.m.	Oec, room 5016	mid-term presentation
Monday, 24.06.2024	until 12:00 p.m.	secretary office (Oec, room 4014)	submission of seminar paper
Monday, 15.07.2024	08:00 a.m. – 05:00 p.m.	Oec, room 5016	final presentation

* In addition to registering at the group, students must also register the seminar at the examination office. The necessary [form](#) (to be filled out immediately after the kick-off event!) must be signed by Prof. Souren.

Preliminary Topics

Part A: Algorithms and Methods for Assembly Line Balancing Problems

1. Assembly Line with Two-sided or Multi-manned Workstations
2. Parallel Assembly Lines
3. U-shaped Assembly Line
4. Consideration of Processing Alternatives
5. Consideration of Non-deterministic Processing Times and Breakdowns
6. Consideration of Setups
7. Consideration of an Alternative Objective or Multiple Objectives

Part B: Algorithms and Methods for Job Shop Scheduling Problems

8. Consideration of Path Flexibility
9. Consideration of Non-deterministic Processing Times and Breakdowns
10. Consideration of Setups
11. Consideration of an Alternative Objective or Multiple Objectives

Introductory Literature

The research field of assembly line and job shop production processes is very comprehensive. The following reviews provide an insight into current research:

- Boysen, N./Schulze, P./Scholl, A.: Assembly line balancing: What happened in the last fifteen years?, in: European Journal of Operational Research, Vol. 301, 2022, p. 797–814.
- Xiong, H./Shi, S./Ren, D./Hu, J.: A survey of job shop scheduling problem: The types and models, in: Computers & Operations Research, Vol. 142, 2022, 105731.

(Access to both publications is possible in the university network or with a VPN connection to the university.)

The search for thematically suitable sources on the individual topic is the responsibility of the seminar participants and can be carried out using the common databases if suitable keywords are selected. (A database overview can be found in the database information system of the Ilmenau University Library, which can be accessed at <https://www.tu-ilmenau.de/en/university/quick-links/university-library/find-use>). You are welcome to ask Ms. Wöhlert M. Sc. and Prof. Souren for advice on literature research and assessment, and you can also contact them by e-mail if you have further questions.