Research area:
Production Management
and Supply Chain Logistics

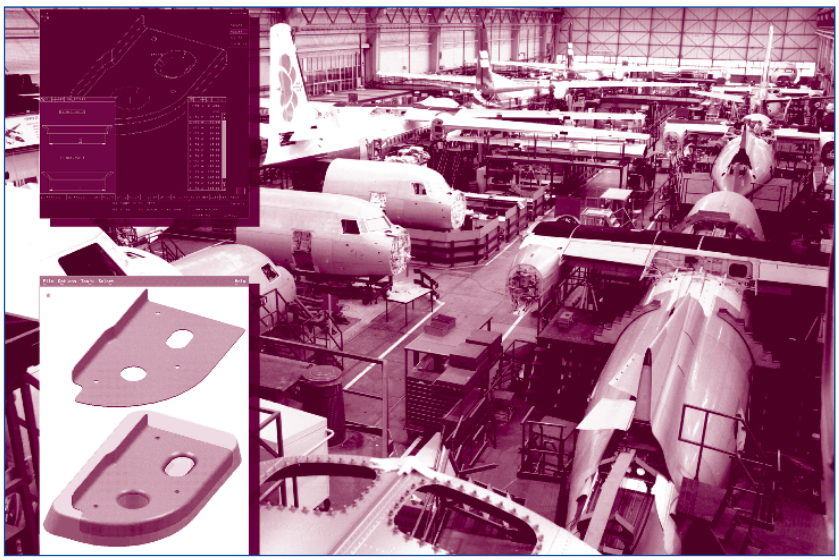
Gerhard Wullink

Intelligent planning in real-life project environments

Gerhard Wullink is working on a novel method for intelligent capacity planning in multi-project environments involving uncertainties. He has now been engaged in PhD research for a year and a half and is currently testing his method in a case study of the planning of complex repair projects in a shipyard. For the economically weak ship repair business, Wullink's new planning methods may make the difference between being in the black or in the red.

"Uncertainties are not only a real factor in everyday life, they are part of business, too. Take for instance made-to-order manufacturing. The customer determines what should be manufactured and when, and occasionally even supplies the specifications. Every customer and every order is different, which makes planning very hard. Before the work begins, it is uncertain which operations have to be performed and which resources will be required. The challenge is to take into account as many uncertainties as possible and still be able to draw up a sensible planning schedule."

"To tackle this problem, I use advanced techniques from operations research. Combining all possible events regarding the customer, his order and the manufacturing environment yields a huge number of scenarios. I therefore start by determining a representative set of scenarios. Using a deterministic technique, I construct a number of possible plans. I then have to evaluate which plan yields the best score for this set of scenarios. At the moment, my discussion with practitioners revolves around the type of criteria to be used for this evaluation. The question is: what makes up a robust plan? I have to consider criteria like average cost of using non-regular capacity, variance of these costs over different scenarios or utilisation of resources. My job is to devise algorithms that draw up plans that fit these requirements as far as possible."



Examples of current projects:

- Modelling and design of automated transport systems
- Mathematical and statistical analysis of initial purchase decisions
- Control of control charts

"What I just outlined for real-life manufacturing also applies to project environments. Common planning software systems are single-project oriented and assume infinite capacity. In practice, project organisations usually run several projects simultaneously, with limited capacity. Since projects compete for the same scarce capacity, multi-project planning techniques are needed that take uncertainty into account. Take the ship repair business where I am currently conducting my case study. From an economic point of view, the ship repair business in the Netherlands is unstable. One minute there is an underload, and the next minute people are working overtime. A lot can be gained by capacity planning. But when you tell that to the planners working in this business, their first reaction is to claim that there are too many uncertainties for that kind of planning. That's precisely my challenge, to show that it is possible to plan intelligently."

"Take a simple example. When a large repair project for a ship includes an inspection of a ship's screw, you may expect only a few minor repairs. However, it may turn out that you have to replace the complete screw. This will take up more working days and will overturn your original plan. If you plan this at the end of the repair period, then you will inevitably pass the deadline. When, however, you have foreseen this possibility, you can plan this operation at an early stage of the project, so that the plan can be modified when this event actually occurs."

"The goal of this case study is to improve the productivity of ship repair by intelligent planning. But I also see applications in various other areas. For instance, in the construction business, where parties are mostly working on several complex building projects simultaneously, I see room for project planning improvement. In health care you also find complex project environments, such as capacity planning for an operating theatre. Here, examples of typical uncertainties include emergency cases or a patient not showing up. I expect that the intelligent planning methods we are developing within this CTIT research area will also be applicable in such environments.