Investigating the impact of deadlines in the Twilight manufacturing model

Supervisors:
Marc Geilen (m.c.w.geilen@tue.nl)
Joost van Pinxten (j.h.h.v.pinxten@tue.nl)
Joao Bastos (j.p.nogueira.bastos@tue.nl)

The Twilight System [1] is an example created for the study of controller synthesis and performance analysis of Manufacturing Systems. This manufacturing system is a simplification of the product handling model that has been created at ASML the world-leading manufacturer of lithography systems, using similar kinds of peripherals and resources.

Our example system contains four resources. First, there are two robots to transport balls; the load robot (LR) and the unload robot (UR). Each robot has a homing position; LR on the left corner, and UR on the right corner. The other two resources are processing stations, the conditioner (COND) to ensure a right ball temperature, and the drill (DRILL) to drill a hole in a ball. Both robots have three peripherals; a clamp (CL) to pick up and hold a ball, an R-motor (R) to move along a rail, and a Z-motor (Z) to move the clamp up and down. Both processing stations have a clamp peripheral. The conditioner has a heater (H), to heat a ball. The drill has an R-motor (R) to rotate the drill bit, and a Z-motor (Z) to move the drill bit up and down.

![Figure 1: A representation of the modules of the Twilight system](image)

Each ball processed by the system follows the same life cycle. First, a ball is picked up at the input buffer by the load robot. Then it is brought to the conditioner and processed. Next, the item needs to be transported before the ball cools down too much by either one of the robots to the drill, where it is drilled. Finally, the drilled ball is transported to the output buffer by the unload robot.

1 Assignment

The model is specified in terms of resources, activities, and dependencies between them. Such models can currently be enhanced with timing information to specify the minimum time difference between two actions. We want to extend the modelling language to enable the specification of a maximum time between two activities.

You will contribute to the semantics and implementation of the extension of the modelling language and tools for the specification of such maximum time differences. To show that this

1 www.asml.com
enables correct modelling of the minimum and maximum time differences, the existing Twilight model needs to be extended.

From past research on production printers [2], we know that the analysis tool-kits need to be extended to deal with such maximum time differences. The generalization will enable the tool-set to analyse a new class of problems.

2 Recommended skills and expertise

We are looking for a student that has at least some affinity with:

- Programming in: Java (extending the modelling language), C++ (analysis toolkits)
- Model-based design and semantics of models
- General interest in Cyber-Physical Systems

3 I want to know more!

The project is hosted by the Electronic Systems (ES) group, Electrical Engineering department.

If you are interested in this assignment, contact Joost van Pinxten (j.h.h.v.pinxten@tue.nl) for more information.

References
