

Automation Systems in Europe

INTEGRATED PLANNING AND CONTROL OF FOREST-BASED SUPPLY CHAINS WITH FOCUS ON FOREST MANAGEMENT: LIMITATION AND POTENTIALITIES

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Insights to Model-Based Control Definitions

What is model-based control?

An IT-solution which, ...

- supervises stock level of a tank (e.g., wood material) with inputs from measured data (basically from sensors) and anticipates future trends based on predictive models;
- automates operations to adjust stock level in an optimised way over time according to targets (set points), constraints and cost functions.

See for example Blanco et al. (2008) and Subramanian et al. (2013)





Controller: optimise over time the adjustment to the set points considering cost functions, constraints and disturbances (cycle of controller is shorter than the planning one)



Insights to Model-Based Control

Implementation

What are the benefits?

- Check stock level on a regular basis (detect current error between set points and stock level)
- Anticipate future states and especially occurring problems
- Coordinate/ undertake operations to adjust to the set points over time in an optimised way

What are the prerequisites?

Need to define set points, constraints, cost functions and predictive models, so that it is possible to delegate stock level supervising jobs to the controller, as well as to send instructions and/or to suggest and/or to launch operations to regulate stock level



Application of MBC to forest-based supply chain: → dynimically interconnected tanks of wood materials



Concept of Planning & Control in forest-based supply chain



Generic controller for one process



Example to illustrate the application of MBC to forest planning → Plenterforest (selection forest)



Challenge: maintain a balanced demograpic structure basically based on the growing stock





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Cost function: f(amount of harvested wood, ...)

Main constraint: growing stock should be kept by +/- 20% of the setpoints

Disturbance: e.g. storm

Limitation and potentialities

- New way to consider forest-based supply chains in terms of dynamically interconnected tanks → potentially powerful technology for collaboration among SC actors/ willingness to share data?!
- Important role of sensor data to supervise stock levels in an automated way;
- Challenge: define which part of planning and control can be delegated to MBC, especially which operations to adjust stock levels over time in an automated way.





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