IWF
Institut für Werkzeugmaschinen und Fertigung
Institute of Machine Tools and Manufacturing

POMDP controller for strategic incineration plant production planning

Keywords / Topics: Model Predictive Plant Control, Contorol under Uncertainty, Modelling, Planning

Abstract

This bachelor thesis investigates the application of a POMDP controller in the field of incineration energy production plants. To model a plant exemplarily as a Markov Decision Process (MDP), the control actions and cost as well as uncertain observations are identified. To evaluate the POMDP controller, the resulting strategy is compared to corresponding results of different predicitive control techniques.

Introduction

The ICVR works in the field of assistance systems, helping the user to make decisions based on simulating and forecasting dynamic systems under uncertainty. As part of the KTI project “WtE – Commercial Optimizer” we develop a controller that suggests operating instructions to the energy plant manager. The automatically generated non-myopic strategy is calculated using predictive control on the dynamic model of the plant and the energy markets. This enables to optimally map the production potential of the plant onto the market needs.

Content

The thesis shows the benefits and drawbacks of using POMDPs in strategic plant control. Comparing the POMDP controller with other stochastic model predictive control methods weights the benefits of considering uncertainty in the strategy versus the high computational efforts. This work will exemplarily show the potential value of POMDP controller in the field of industrial control.

One potential application is the guidance in splitting the produced thermo dynamical energy into the electricity grid and the district heating. The optimal economical strategy depends on production capacity and the market prices and penalties, and is not necessarily congruent to the optimal physical utilization.

Work packages

- Identify control actions of incineration plants
- Develop a MDP model of the financial reward and the system dynamics of the power plant
- Identify observations that indicate the hidden system state of the MDP (sensor model)
- Apply a POMDP planner to determine the optimal production policy offline to a Simulink model
- Compare the outcoming strategy with other (stochastic) model predicive control methods
- Find simplifications to enable online (re)planning for model adaption at runtime
- Document and present results

Requirements

We are looking for students, who would like to work at industrial driven projects in small research teams. Although skills in systems engineering, modeling (Simulink) and programming (C) are welcome, most important is the will to break into the given problem, develop solutions, and solve problems pro actively. Fulfilling the common academic processing is mandatory. You will document and present your results to the institutes’ members in a 20 minutes mid-term and final session.

Information & Administration

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