

## Accepted Manuscript

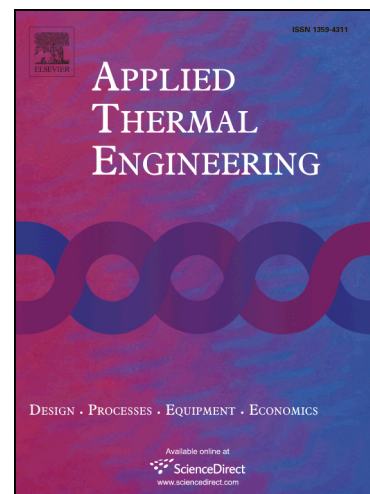
Automated identification of a complex storage model and hardware implementation of a model-predictive controller for a cooling system with ice storage

Sebastian Thiem, Alexander Born, Vladimir Danov, Annelies Vandersickel, Jochen Schäfer, Thomas Hamacher

PII: S1359-4311(17)32900-9  
DOI: <http://dx.doi.org/10.1016/j.applthermaleng.2017.04.149>  
Reference: ATE 10298

To appear in: *Applied Thermal Engineering*

Received Date: 6 September 2016  
Revised Date: 22 March 2017  
Accepted Date: 29 April 2017



Please cite this article as: S. Thiem, A. Born, V. Danov, A. Vandersickel, J. Schäfer, T. Hamacher, Automated identification of a complex storage model and hardware implementation of a model-predictive controller for a cooling system with ice storage, *Applied Thermal Engineering* (2017), doi: <http://dx.doi.org/10.1016/j.applthermaleng.2017.04.149>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Automated identification of a complex storage model and hardware implementation of a model-predictive controller for a cooling system with ice storage

Sebastian Thiem<sup>1,2,\*</sup>, Alexander Born<sup>1,3</sup>, Vladimir Danov<sup>1</sup>, Annelies Vandersickel<sup>3</sup>, Jochen Schäfer<sup>1</sup> and Thomas Hamacher<sup>2</sup>

<sup>1</sup>Corporate Technology, Siemens AG, Günther-Scharowsky-Str. 1, Erlangen, Germany

<sup>2</sup>Chair of Renewable and Sustainable Energy Systems, Technische Universität München, Munich, Germany

<sup>3</sup>Institute for Energy Systems, Technische Universität München, Munich, Germany

\*Corresponding author. E-mail address: [sebastian.thiem@siemens.com](mailto:sebastian.thiem@siemens.com)

E-mail addresses: {sebastian.thiem, vladimir.danov, jochen.js.schaefer}@siemens.com, {sebastian.thiem, annelies.vandersickel, thomas.hamacher}@tum.de, alexander.born@mytum.de

## Abstract

Future sustainable energy systems could increase the share of energy converted from fluctuating renewable energy sources by intelligent model-based predictive control of cooling systems with thermal energy storage. This study investigated an experimental cooling system comprising a compression chiller and an ice storage. A runtime-efficient predictive model for partial charge and discharge of ice storage was derived. In addition, techniques for automatic model determination and adaptation were introduced and examined. The experimental setup involved the development and implementation of a model-predictive controller (MPC) to minimize operating expenses under dynamic electricity pricing based on a forward dynamic programming algorithm. The objective function included energy charges, compressor start-up costs, and terminal costs that depended on the state of charge and state of the chiller at the end of the optimization horizon. Three examples of cases validated and compared the advantages of the MPC over an open-loop (day ahead) optimal control concept. The cases examined the influence of temperature and load forecast inaccuracy, and investigated the coping mechanism of the system to sudden updates

Download English Version:

<https://daneshyari.com/en/article/4991141>

Download Persian Version:

<https://daneshyari.com/article/4991141>

[Daneshyari.com](https://daneshyari.com)