

Continuous Dynamic First Principles Models

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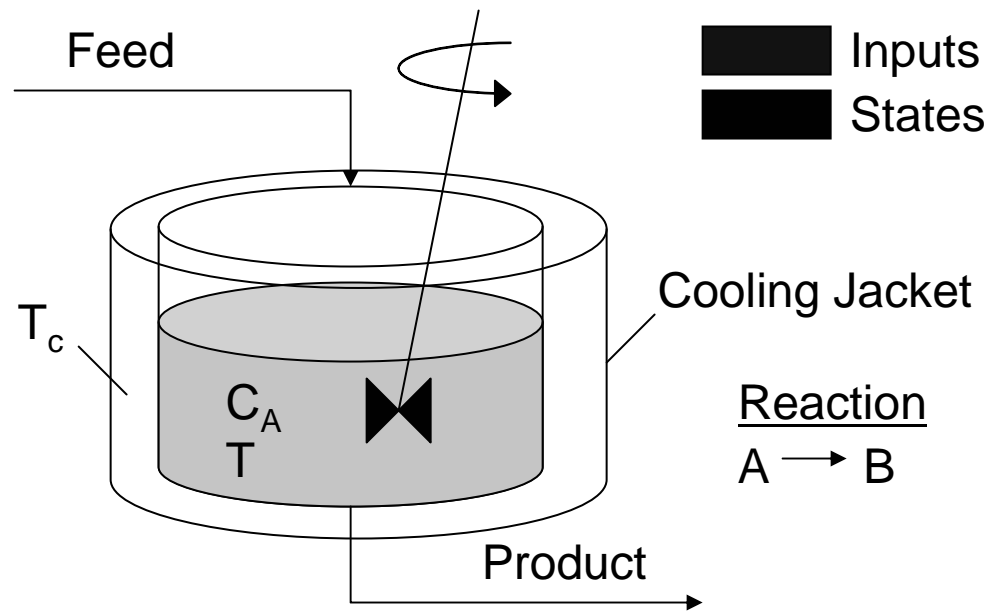
Introduction

- Objectives:
 - Test ISAT with a variety of nonlinear models.
 - Create a forum to share chemical and mechanical first principles models.
- Please contribute your well documented model by e-mailing: john@che.utexas.edu

Summary

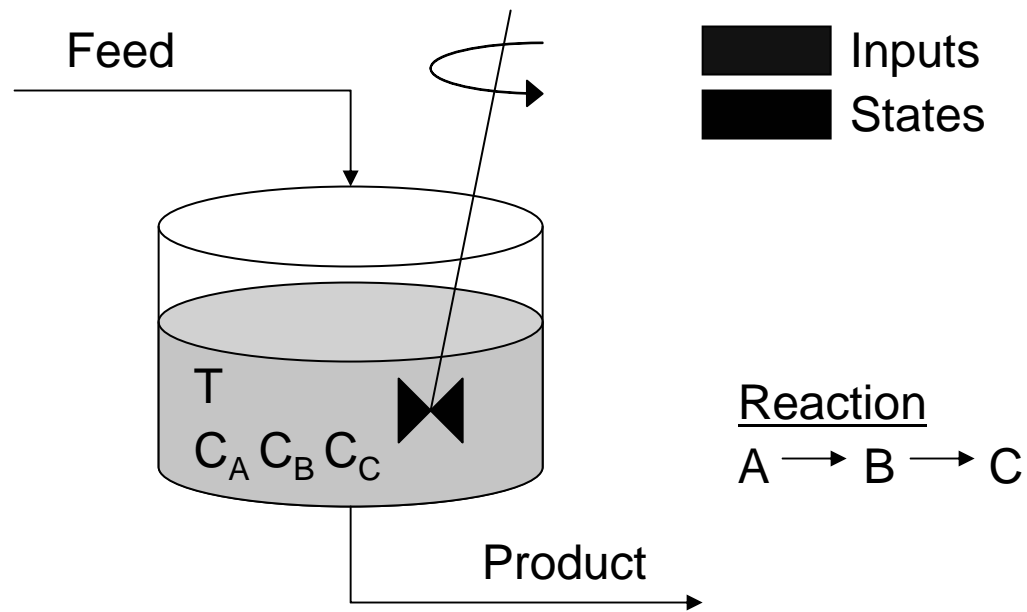
<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Inputs: States</u>
1	CSTR with Jacket Dynamics (A->B)	ODE	1:2
3	CSTR with Jacket Dynamics (A->B->C)	ODE	1:3
4	2 CSTRs in Series (A->B)	ODE	2:6
5	2 CSTRs in Series with Jacket Dyn (A->B)	ODE	1:4
6	Inverted Pendulum	ODE	1:2
8	Distillation Column (Constant Relative Volatility)	ODE	1:32
11	Cruise Control	ODE	1:1
12	Cruise Control (with Disturbance)	ODE	1:1
13	Distillation Column with Wilson Eq and P_{sat}/P constant	ODE	1:32
14	Distillation Column with Wilson Equation	DAE	1:64
18	Distillation Column with Enthalpy Equation	DAE	2:125

Model 1: CSTR



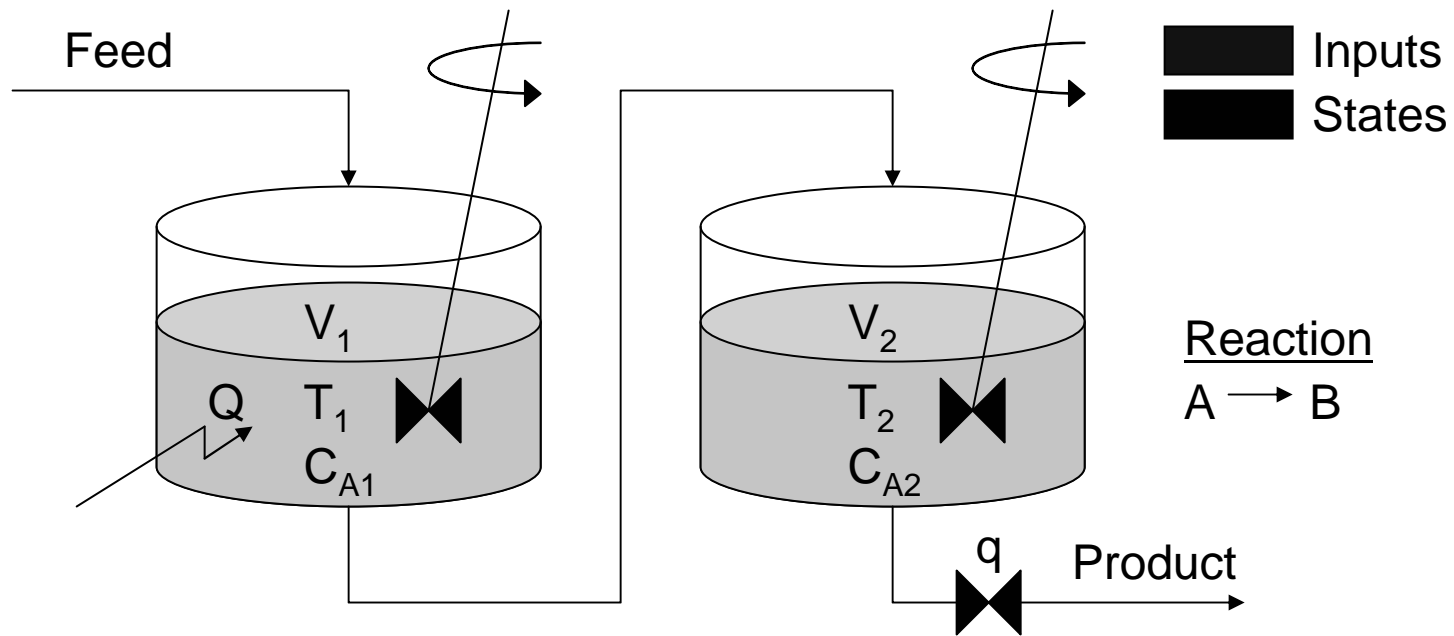
Henson, M.A. and Seborg, D.E., Feedback Linearizing Control, Chap. 4 of Nonlinear Process Control, Edited by Hensen, M.A. and Seborg, D.E., Prentice Hall (1997)

Model 3: CSTR



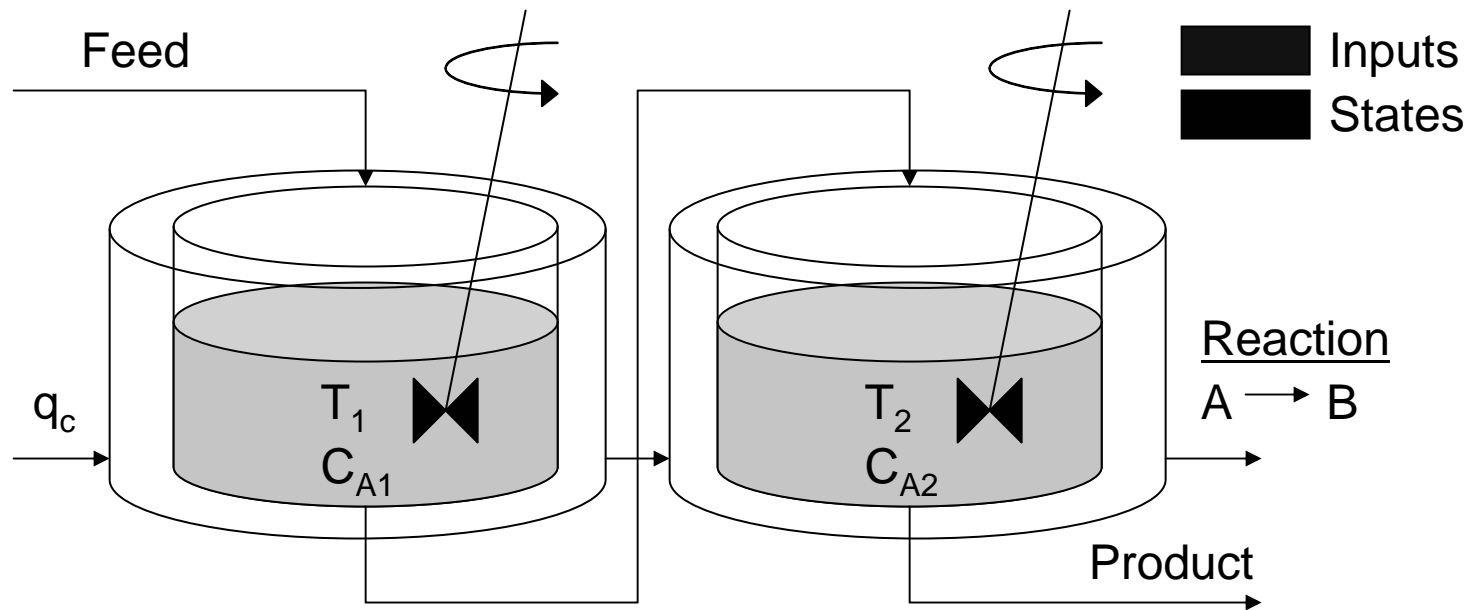
M. J. Tenny and J. B. Rawlings. Closed-loop behavior of nonlinear model predictive control. Texas-Wisconsin Modeling and Control Consortium Report TWMCC-2002-03.

Model 4: Dual CSTR



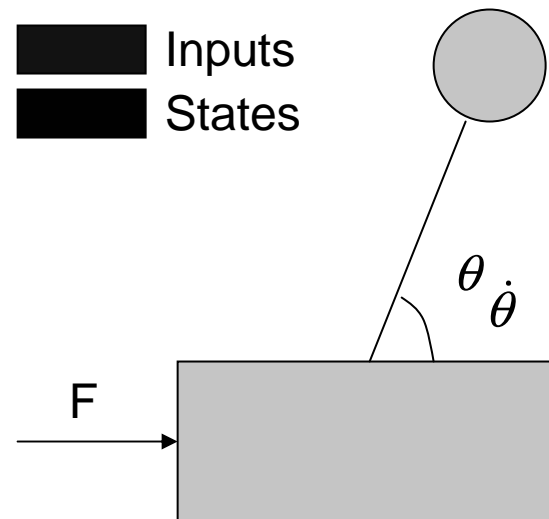
Hahn, J. and T.F. Edgar, An improved method for nonlinear model reduction using balancing of empirical gramians, Computers and Chemical Engineering, 26, pp. 1379-1397, (2002)

Model 5: Dual CSTR



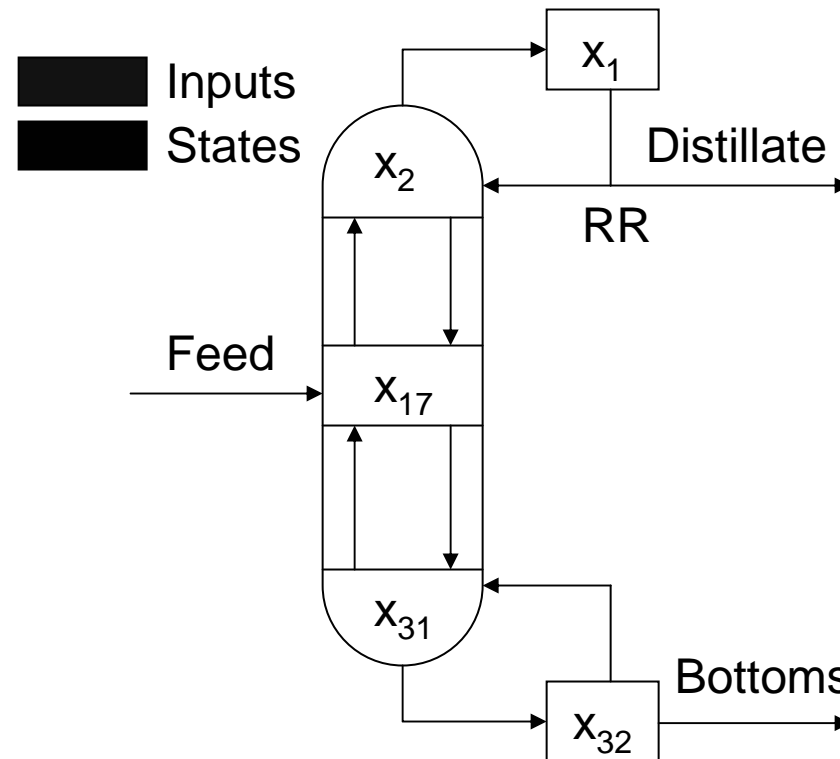
Henson, M.A. and Seborg, D.E., Feedback Linearizing Control, Chap. 4 of Nonlinear Process Control, Edited by Hensen, M.A. and Seborg, D.E., Prentice Hall (1997)

Model 6: Inverted Pendulum



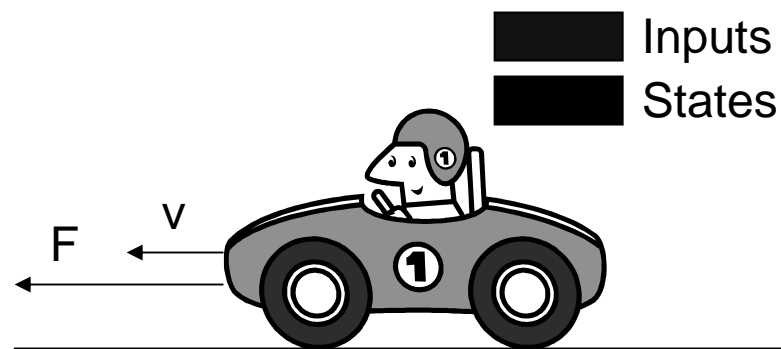
John Hauser and Hinke Osinga. On the geometry of optimal control: the inverted pendulum example. In Proceedings of the American Control Conference, pages 1721-1726, Washington, DC, 2001.

Model 8: Binary Distillation



Hahn, J. and T.F. Edgar, An improved method for nonlinear model reduction using balancing of empirical gramians, Computers and Chemical Engineering, 26, pp. 1379-1397, (2002)

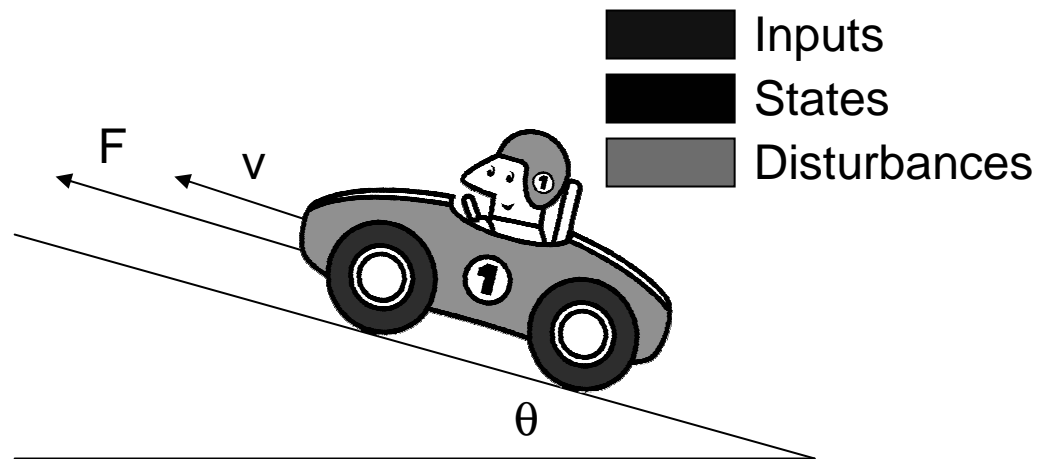
Model 11: Cruise Control



Source: <http://www.engin.umich.edu/group/ctm/examples/cruise/cc.html>

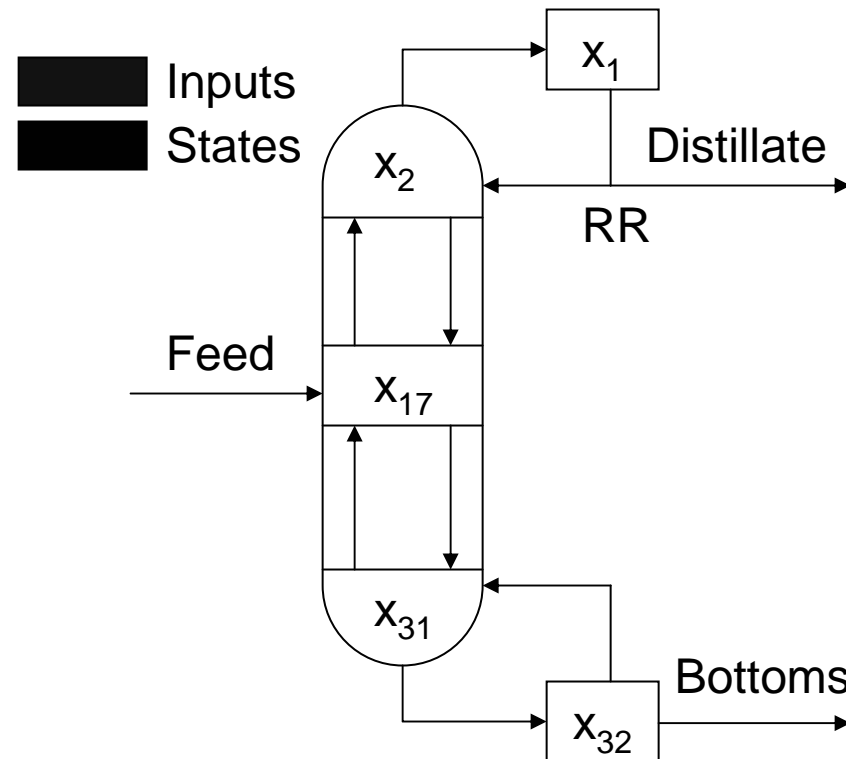
Date: July 2003

Model 12: Cruise Control



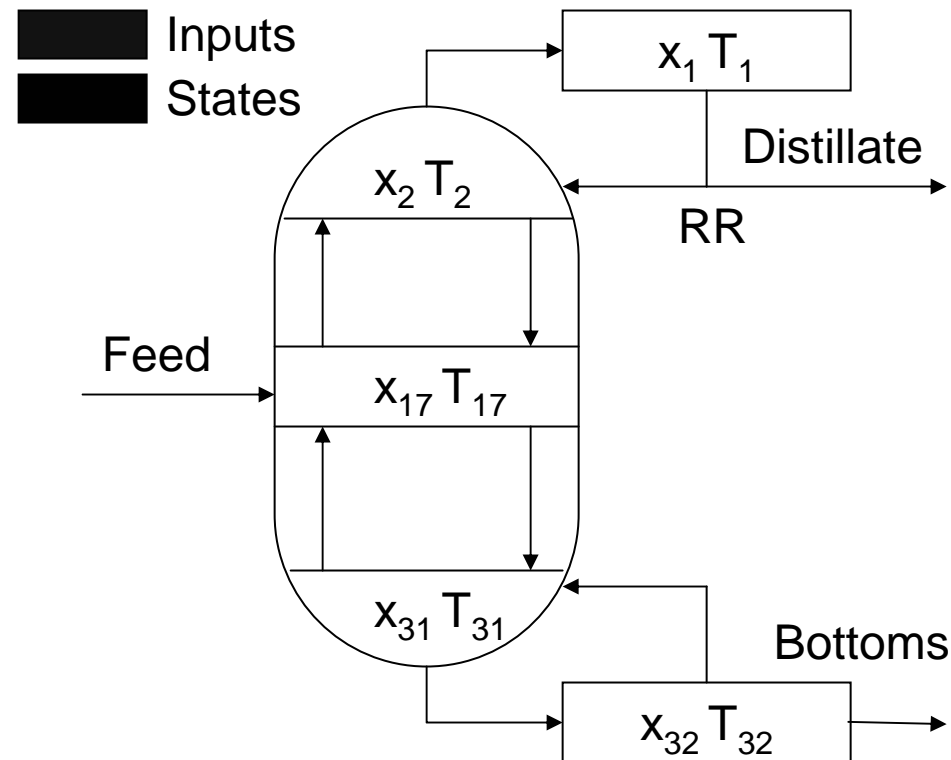
Created by: John D. Hedengren
Date: July 2003

Model 13: Binary Distillation



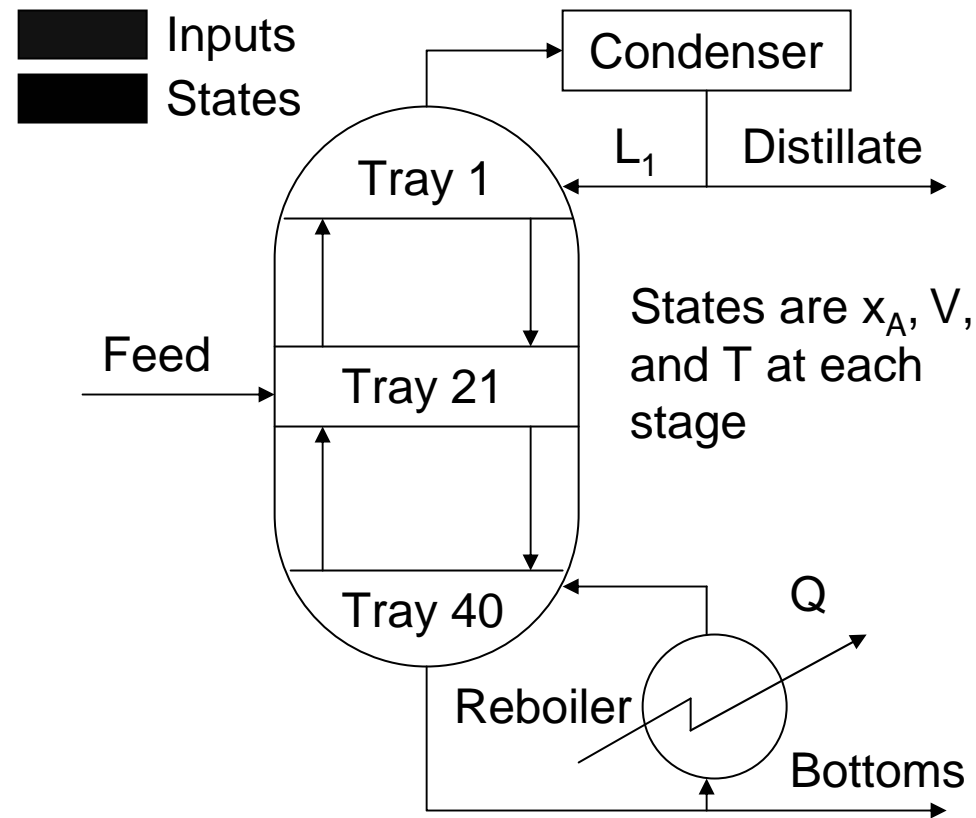
Created by: John D. Hedengren
Date: July 2003

Model 14: Binary Distillation



Created by: John D. Hedengren
Date: July 2003

Model 18: Binary Distillation



Diehl, M., "Real-Time Optimization for Large Scale Nonlinear Processes", PhD thesis, University of Heidelberg, 2001.

M. Diehl, I. Uslu, S. Schwarzkopf, F. Allgöwer, H.G. Bock, R. Findeisen, E.D. Gilles, A. Kienle, J.P. Schlöder, and E. Stein: Real-Time Optimization for Large Scale Processes: Nonlinear Model Predictive Control of a High Purity Distillation Column In Groetschel, Krumke, Rambau (eds.): Online Optimization of Large Scale Systems: State of the Art, Springer, 2001.