

## Reading and Reference List

### Engineering Control Theory: Can it Impact Adaptive Interventions?

Daniel E. Rivera, Ph.D.

School of Mechanical, Aerospace, Chemical and Materials Engineering,  
Arizona State University, Tempe, AZ 85287-6106,  
e-mail: [daniel.rivera@asu.edu](mailto:daniel.rivera@asu.edu); <http://csel.asu.edu/health>

*An excellent introduction to the topic of adaptive interventions:*

[1] Collins, L.M., S.A. Murphy, and K.L. Bierman, "A conceptual framework for adaptive preventive interventions," *Prevention Science*, **5**, No. 3, pgs. 185-196, 2004.

*A paper inspired by [1] that is the basis for much of the content in this tutorial:*

[2] Rivera, D.E., M.D. Pew, and L.M. Collins, "Using engineering control principles to inform the design of adaptive interventions: a conceptual introduction," *Drug and Alcohol Dependence*, Special Issue on Adaptive Treatment Strategies, **88**, Suppl. 2, May 2007, pgs. S31 - S40.

*A report that describes the technical content in [2] in more detail:*

[3] Rivera, D.E., M.D. Pew, L.M. Collins and S.A. Murphy, "Engineering control approaches for the design and analysis of adaptive, time-varying interventions," Technical Report 05-73, The Methodology Center, Penn State University, available from <http://methcenter.psu.edu/> or <http://csel.asu.edu/adaptivintervention> (select item 4).

*A tutorial on mechanistic dynamic modeling and control theory that I presented at the 2007 SAMSI (Statistical and Applied Mathematical Sciences Institute) program on Challenges in Dynamic Treatment Regimes and Multistage Decision-Making:*

[4] Rivera, D.E., "An Introduction to Mechanistic Models and Control Theory," tutorial presentation at the SAMSI Summer 2007 Program on Challenges in Dynamic Treatment Regimes and Multistage Decision-Making, June 18 - 29, 2007. Can be downloaded from <http://csel.asu.edu/controleducation> (select item 9).

*Some good process modeling and control texts; these focus on mechanistic models of engineering systems, and require prior working knowledge of differential equations:*

[5] B.A. Ogunnaike and W.H. Ray, **Process Dynamics, Modeling, and Control**, Oxford University Press, 1994, ISBN 0-19-509119-1.

[6] Seborg, D.E., T.E. Edgar, and D.A. Mellichamp, **Process Dynamics and Control**, 1989, Wiley, ISBN 0-471-86389-0; (2nd Edition released in 2004, ISBN 0-471-00077-9).

[7] Bequette, B.W. **Process Dynamics: Modeling, Analysis, and Simulation**. Prentice-Hall, 1998. ISBN 0-13-206889-3.

*A free web-based reference for introductory control engineering theory, written by two eminent control systems engineers:*

[8] Åström, K. J. and R. M. Murray, **Feedback systems: an introduction for scientists and engineers**,” <http://www.cds.caltech.edu/~murray/amwiki>.

*A tutorial on system identification (i.e., dynamic modeling from data) that I presented as a Penn State Methodology Center brown bag talk:*

[9] Rivera, D.E., “A Brief Introduction to System Identification,” Penn State Methodology Center Brown Bag presentation, March 20, 2008. Can be downloaded from <http://csel.asu.edu/controleducation> (select item 10).

*System identification and feedback control, presented from a primarily statistical perspective:*

[10] Box, Jenkins, and Reinsel, **Time Series Analysis: Forecasting and Control**, Third Edition, Prentice-Hall, 1994 (2nd edition is also useful, Box and Jenkins, Holden-Day, 1976).

*Some good references on Internal Model Control and Model Predictive Control:*

[11] Rivera, D.E., M. Morari, and S. Skogestad, “Internal Model Control 4. PID controller design,” *Ind. Eng. Chem. Proc. Des. and Dev.*, **25**, 252, 1986.

[12] Morari, M. and E. Zafiriou. **Robust Process Control**. Englewood Cliffs, New Jersey: Prentice Hall, 1989.

[13] García, C. E., D. M. Prett, and M. Morari, “Model Predictive Control: Theory and Practice- a Survey.” *Automatica* 25(3), 335–348, 1989.

[14] Camacho, E. F. and C. Bordons. **Model Predictive Control in the Process Industry. Advances in Industrial Control**. London: Springer, 2004.

*Some system identification texts written (or co-authored) by Lennart Ljung, an eminent scholar in the field and developer of Matlab’s System Identification Toolbox:*

[15] Ljung, L. and T. Glad, **Modeling of Dynamic Systems**, Prentice-Hall, 1994, (ISBN 0-13-597097-0).

[16] Ljung, L. **System Identification: Theory for the User**, 2nd Edition, Prentice-Hall, 1999 (ISBN 0-13-656695-2).

*This paper shows how to represent the Theory of Planned Behavior as a dynamical system:*

[17] Navarro-Barrientos, J.E., D.E. Rivera, and L.M. Collins, “A dynamical systems model for understanding behavioral interventions for weight loss,” S.-K. Chai, J.J. Salerno, and P.L. Mabry (Eds.): *2010 International Conference on Social Computing, Behavioral Modeling, and Prediction (SBP 2010)*, LNCS 6007, pp. 170-179. Springer, Heidelberg (2010). Preprint available from <http://csel.asu.edu/adaptiveintervention> (select item 7).

*Recent work from our laboratory showing how a Model Predictive Control formulation can be used for decision-making in adaptive behavioral interventions:*

[18] Nandola, N. and D.E. Rivera, “A robust Model Predictive Control formulation for hybrid systems with application to adaptive behavioral interventions,” *Proceedings of the 2010 American Control Conference*, Baltimore, MD, June 30 - July 2, 2010, in press. Preprint available from <http://csel.asu.edu/adaptiveintervention> (select item 8).