

Clifford S. Bonaventura, Ph.D.

Manager Analytic Engineering

ZETA TECH

A Harsco Track Technologies Business Unit

Over 10 year's expertise in system dynamics, railway vehicle-track dynamics, systems and system interaction.

Professional History

1999 -
Present

ZETA-TECH Associates, Inc., Cherry Hill, New Jersey

ZETA-TECH a Harsco Rail Business Unit

Manager Analytic Engineering

Developed a real-time dynamic simulation for a rail vehicle's response to track geometry. Included tests for unsafe vehicle operating conditions and used them to report safety warnings and violations and to determine critical speed boundaries for vehicle operation.

Product management and development of *TieInspect*TM, a system used to gather detailed tie condition data on a tie-by-tie basis. Enhanced the *TieInspect* system to include implementation of tie replacement logic and the ability to identify – in track – the ties to be replaced according to the replacement logic criteria.

Designed a modified geometry for a railroad turnout (switch) that reduces peak lateral forces allowing a higher operating speed. New geometry designed to be incorporated as a low-cost retrofit of existing turnouts.

Jun–Nov 1996
Jun–Aug 1995

Sandia National Laboratories, Albuquerque, New Mexico

Summer Student Intern

Developed a modular approach to the dynamic simulation of complex robot systems. Systems considered included multiple robots with multiple constraints and external contacts. Developed a “SMART” module for the real-time dynamic simulation and control of a flexible, long-reach robot arm.

Sep 1992 -
Mar 1994

NASA/Lockheed Engineering and Sciences Co., Houston, Texas

Student Researcher

Contracted to enhance the existing computer simulation of the Space Shuttle Remote Manipulator System. Enhancement allowed for efficient and accurate simulation of the shuttle robot arm performing constrained motion tasks.

Education

1994 – 2002

Pennsylvania State University, University Park, Pennsylvania

Ph.D. in Mechanical Engineering, Thesis: “A Modular Approach to the Dynamics of Complex Robot Systems”

1992 - 1994

Master of Science in Mechanical Engineering, Master's Paper: “Development of a Constrained Motion Algorithm for the Shuttle Remote Manipulator System (SRMS)”

1988 - 1991

Bachelor of Science in Mechanical Engineering

Honors and Awards

National Science Foundation (NSF) Graduate Trainee in Environmentally Conscious Manufacturing (1995 – 1999)

1st Place – Leonhard Center Robotics Design Challenge

Published Papers

Bonaventura, C.S., Holfeld, D.R., Zarembski, A.M., Palese, J.P., “Test Results of a Modified Turnout Designed to Increase Diverging Route Speeds Without Increasing Lead Length”, **2005 AREMA Annual Conference**, Chicago, IL, September 25-28, 2005

Bonaventura, C.S., Zarembski, A. M., Palese, J.W., “TrackSafe: A Track Geometry Car Based Real-Time Dynamics Simulator”, **ASME 2005 Joint Rail Conference**, Pueblo, CO, March 16-18, 2005.

Bonaventura, C.S., Zarembski, A.M., Palese, J.W., Holfeld, D.R., “Increasing Speeds through the Diverging Route of a Turnout without Increasing Lead Length”, **83rd TRB Annual Meeting**, Washington, DC, January 11-15, 2004.

Bonaventura, C.S., Zarembski, A.M., Palese, J.W., Holfeld, D.R., “Increasing Speeds through the Diverging Route of a Turnout Without Increasing Lead Length, **Railway Track & Structures**, July 2004

Bonaventura, C.S., Palese, J.W., Zarembski, A.M., “Performance of a Track Geometry Car-Based Real-Time Dynamics Simulator using Multiple Vehicle Types, **2003 ASME International Mechanical Engineering Congress and Exposition (IMECE’03)**, Washington, DC, November 16-21, 2003.

Bonaventura, C.S., Palese, J.W., Zarembski, A. M., “Field Evaluation and Deployment of a Track Geometry Car Based Real-Time Dynamics Simulator”, **AREMA 2003 Annual Conference & Exposition**, Chicago, IL, October 5-8, 2003.

Bonaventura, C.S., Palese, J.W., Zarembski, A.M., “Real-Time Prediction of Railway Vehicle Response to the Interaction with Track Geometry”, **International Heavy Haul Conference**, May 2003.

Zarembski, A.M., Blaze, J., “The Economics of Heavy Axle Loads: Costs and Benefits”, published at the **Heavy Haul: The Solution for Europe’s Future**, Paris, March 2003.

Bonaventura, C. S. and K. W. Jablokow, “A Modular Approach to the Dynamics of Complex Multi-Robot Systems,” *IEEE Journal of Robotics and Automation*. (to appear 2004).

Bonaventura, C. S. and K. W. Jablokow, “A Modular Dynamic Simulation Algorithm for Complex Robot Systems” *Proceedings of the 2004 IEEE International Conference on Robotics and Automation*, New Orleans, LA, April 26-May 1, 2004.

Bonaventura, C. S., A. M. Zarembski, J. W. Palese, and D. R. Holfeld, “Increasing Speeds Through the Diverging Route of a Turnout Without Increasing Lead Length,” *83rd TRB Annual Meeting*. Washington, D.C., January 11-15, 2004.

Bonaventura, C. S., J. W. Palese, and A. M. Zarembski, “Performance of a Track Geometry Car-Based Real-time Dynamics Simulator using Multiple Vehicle Types,” *Proceedings of IMECE 2003: 2003 International Mechanical Engineering Congress and Exposition*. Washington, D.C., November 16-21, 2003.

Jablokow, K. W. and Bonaventura, C. S., “Alternate Forms of the Operational Space Inertia Matrix for the Dynamic Simulation of Complex Robot Systems” *Proceedings of the 2003 IEEE International Conference on Systems, Man, and Cybernetics*, Washington, D. C., October 5-8, 2003.

Bonaventura, C. S., J. W. Palese, and A. M. Zarembski, “Field Evaluation and Deployment of a Track Geometry Car Based Real-time Dynamics Simulator,” *American Railway Engineering Maintenance Association Annual Technical Conference*. Chicago, IL, October 5-8, 2003.

Zarembski, A. M., L.A. Parker, J. W. Palese, and C. S. Bonaventura, "Computerized Tie Condition Inspection and Use in Tie Maintenance Planning," *IHHA Proceeding of the Implementation of Heavy Haul Technology for Network Efficiency*, pp. 6.19-6.25 Dallas, TX, May 5-9 2003.

Bonaventura, C. S., J. W. Palese, and A. M. Zarembski, "Real-time prediction of Railway Vehicle Response to the Interaction with Track Geometry," *IHHA Proceeding of the Implementation of Heavy Haul Technology for Network Efficiency*, pp. 5.1-5.9, Dallas, TX, May 5-9 2003.

Bonaventura, C. S. and K. W. Jablokow, "An O(N) Modular Algorithm for the Dynamic Simulation of Robots Constrained by a Single Contact," *IEEE Journal of Systems, Man, and Cybernetics – Part C: Applications and Reviews*, vol. 32, no. 4, pp. 406 – 415, November 2002.

Bonaventura, C. S., J. W. Palese, and A. M. Zarembski, "Intelligent System for Real-time Prediction of Railway Vehicle Response to the Interaction with Track Geometry", *Proceedings of the 2000 ASME/IEEE Joint Railroad Conference*, pp. 31-45, April 2000.

Bonaventura, C. S. and K. W. Lilly, "A Constrained Motion Algorithm for the Shuttle Remote Manipulator System", *IEEE Control Systems*, vol. 15, no. 5, pp. 6–16, October 1995.

Lilly, K. W. and C. S. Bonaventura, "A Generalized Formulation for Simulation of Space Robot Constrained Motion," *Proceedings of the 1995 IEEE International Conference on Robotics and Automation*, pp. 2835 – 2840, 1995.

Bonaventura, C. S. and K. W. Lilly, "Development of a Constrained Motion Algorithm for the Shuttle Remote Manipulator System (SRMS)," *Proceedings of the 1994 IEEE International Conference on Systems, Man, and Cybernetics*, pp. 2254-2259, 1994.