

INTRODUCTION TO THE BOND GRAPH METHOD FOR MODELING AND SIMULATION

Jose J. Granda
Department of Mechanical Engineering
California State University, Sacramento
6000 J Street, Sacramento, CA, 95819
grandajj@ecs.csus.edu

ABSTRACT

This tutorial is intended for those who do not know the bond graph method but would like to learn it. If you do not know what bond graphs are, never used the method or want to get started with this technology, this tutorial is for you. The idea is to start at ground zero and give the audience a good start on the bond graph modelling method and simulation. The Bond Graph modelling method is ideal for systems involving components in mechanical, electrical, hydraulic, and thermal or a combination of them.

Tutorial topics include:

- What are bond graphs?
- How they model a real physical dynamic system
- Basic Definitions. Bond Graphs, vs Block Diagrams
- Basic Physical Elements and fundamental laws
- Modelling and simulation in the time domain
- Mechanical Systems
- Electrical Systems
- Hydraulic Systems
- Computer generated differential equations, transfer functions and state space form for the time and frequency domain

REFERENCES

- Granda, J.J. and Glockler, T. “Bond Graph Models for Reconstruction of Vehicle Barrier Equivalent Speeds” *12th International Conference on Bond Graph Modeling and Simulation (ICBGM’2016)* Montreal, Canada , July 2016.
- Granda, J. J., Nguyen, L., Carlson, T., Brocker, S., Sahragard-Monfared, G., and Fornalski E. “Morpheus Planetary Lander Liquid Propellant Fluid Slosh Modeling and Simulation Methods” *12th International Conference on Bond Graph Modeling and Simulation (ICBGM’2016)* Montreal, Canada, July 2016.
- Granda, J. J. “Bond Graph Modeling and Simulation Technology in Forensic Engineering” *SFES Conference*. The Society of Forensic Engineers and Scientists Yosemite, CA February, 2016.
- Granda, J. J. “Developments in Computer Simulations to Understand Vehicle Dynamics, Crash Reconstruction and Measurements” *SFES Conference*. The Society of Forensic Engineers and Scientists Mount Hood, Oregon, September 2015.

Granda

AUTHOR BIOGRAPHY

JOSE J. GRANDA is a full-time professor at the Department of Mechanical Engineering at California State University in Sacramento, CA. He is a NASA Faculty Fellow. He received his Ph.D. in Mechanical Engineering from the University of California, Davis in 1982.