

## **Fundamentals of Modeling & Simulations - Course Justification**

Simulation enables the study of, and experimentation with, interactions of a complex system. Changes can be made to parameters or components of the simulation model, and the effect of those alterations on the model's behavior can be readily observed. Furthermore, changing simulation inputs and observing the resulting outputs can produce valuable insights into which variables are most important and most sensitive. Additionally, simulation models can be used to verify analytic solutions, or provide analysis of systems deemed too complex to analyze mathematically.

The fundamental advantage to the use of modeling and simulations (M&S) is cost. The cost of building and operating an effective digital model or simulation is almost always a fraction of the cost to actually build and operate a physical model or simulation. Many modern systems are so complex that study of their interactions can only be done through simulation.

Amongst numerous disciplines there is a growing demand for expertise in the building of models and simulations - business, engineering, government, etc. Consequently, there is a critical need for a course that provides the fundamentals of M&S: discrete-event systems, available M&S tools, mathematical and statistical modeling, verification and validation and other applications that leverage the advantages of M&S. This undergraduate-level course will thoroughly prepare students with the tools and ideas required to understand and develop a broad spectrum of M&S applications.

There are many industrial, and academic positions available in high-tech companies, national labs, universities and government requiring people with CS-related degrees who have solid understanding of M&S. This course can pave the way for the students who seek such positions, and also prepare them for more rigorous graduate-level courses in M&S.