

Core Concept: Modeling & Simulation

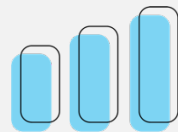
Engineering Literacy Dimension: Engineering Practices

Practice: Quantitative Analysis

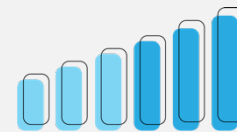
Overview: *Modeling & Simulation* is the process of using a variety of media, both physical and digital, to determine how well a design idea will perform as well as to communicate a design idea to others. Sophistication in this process requires knowledge related to (a) *creating scaled physical models*, (b) *developing computational simulations*, (c) *establishing mathematical models*, (d) *collecting data through destructive testing and failure analysis*, and (e) *design validation through calculations*. This core concept is important to the practice of Quantitative Analysis as modeling and simulating actual events, products, structures, or conditions through mathematical, physical, and graphical/computer models helps engineering professionals to predict the effectiveness of their solutions prior to producing a high-fidelity prototype which can save valuable resources (time, materials, money, etc.).

Performance Goal for High School Learners

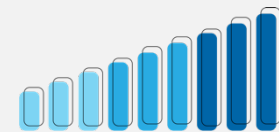
I can successfully develop and use a variety of models or methods to simulate, evaluate, improve and validate design ideas.



Basic



Proficient



Advanced

PHYSICAL MODELS

I can identify and explain the objectives and plans of modeling and testing a physical model.

I can apply or develop a physical model to obtain appropriate evaluation data.

I can predict and refine my solution or choose the final solution from among possible ideas by testing my design ideas with a physical model.

COMPUTATIONAL SIMULATIONS

I can identify and explain the objectives and plans of modeling and testing a computational simulation model.

I can apply or develop a computational simulation model to obtain appropriate evaluation data.

I can predict and refine my solution or choose the final solution from among possible ideas by testing my design ideas with a computational simulation model.

MATHEMATICAL MODELS

I can identify and explain the objectives and plans of modeling and testing a mathematical model.

I can apply or develop a mathematical model to obtain appropriate evaluation data.

I can predict and refine my solution or choose the final solution from among possible ideas by testing my design ideas with a mathematical model.

FAILURE ANALYSIS AND DESTRUCTIVE TESTING

I can identify and explain the objectives and plans of failure analysis and destructive testing.

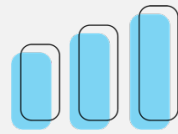
I can apply failure analysis and destructive testing procedures to evaluate and determine the robustness of a design idea.

I can develop and implement an appropriate destructive test or failure analysis to evaluate and determine the robustness of a design idea.

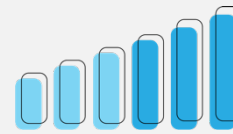
Core Concept: Modeling & Simulation Cont.

Performance Goal for High School Learners

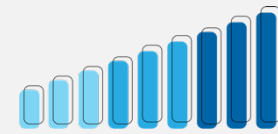
I can successfully develop and use a variety of models or methods to simulate, evaluate, improve and validate design ideas.



Basic



Proficient



Advanced

DESIGN VALIDATION

I can identify and explain the objectives and plans of engineering calculations for design validation.

I can apply engineering calculation procedures to validate a certain design idea.

I can predict and refine my solution or choose the final solution from among possible ideas by testing my design ideas with engineering calculations.