Using **Computational Thinking** to foster learning curiosity

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MathWorks
“Computational Thinking is the thought processes involved in formulating problems and their solutions ... in a form that can be effectively carried out by an information-processing agent.”

- Cuny, Snyder, Wing
Characteristics of Computational Thinking:

**Decomposition**
Break 1 complex problem into a collection of smaller/simpler problems

**Abstraction**
Mathematical modelling
- Symbolic representation
- Block diagrams

**Algorithms + Automation**
Formulating solution as a series of steps
Transforming between Modelling paradigms

**Simulation**
What happens when?
Characteristics of Computational Thinking:

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  - Symbolic representation
  - Block diagrams

**Algorithms + Automation**
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**Simulation**
- What happens when?

How does MATLAB support Computational Thinking?

Centralize
- Narration
- Rationale
- Implementation

Makes it easy to do this

MathWorks
How does this foster curiosity?

Mathematical modelling
- Symbolic representation
- Block diagrams

Formulating solution as a series of steps

Transforming between Modelling paradigms

Break 1 complex problem into a collection of smaller/simpler problems

Centralize:
- Narration
- Rationale
- Implementation

Tedium is reduced.
Spend more time thinking about the core science.
There is a pathway from small to big problems

What happens when?

Makes it easy to do this

Characteristics of Computational Thinking:

Decomposition

Abstraction

Algorithms + Automation

Simulation
Today’s case study:

**From this**

**Solution pathway**

**To this**

Motivate me.

**Computational Thinking**

- Decomposition
- Abstraction (Model Building)
- Algorithms + Automation
- Simulation
Demo these concepts
Using Computational Thinking and **MATLAB** to foster learning curiosity

Centralization of thought process

Tedium busters

Modelling Choices

MATLAB Live scripts

```plaintext
>> diff()
>> matlabFunctionBlock()
```

\[
m \dddot{x}(t) + k \dot{x}(t) = F - b \frac{d}{dt} x(t)
\]

\[
g(t) = \sin(z(t))^2
\]

\[
dg_{\dot{t}}(t) = 2 \cos(z(t)) \sin(z(t)) \frac{d}{dt} z(t)
\]
Student’s desires:

- How does what I already know:
  - Extend to NEW things
  - Scale from simple to complex things
- I do NOT want to do boring things

Professor’s desires:

- I do want my students to:
  - focus on the science/engineering
  - Think, explore, build
How is Computational Thinking Introduced?

Computational Thinking

Do students just “pick up” computational thinking?

Math Skills

Isn’t math taught systematically and reinforced throughout the curriculum?
How Math is introduced in the curriculum

How is Computational Thinking introduced?
Fostering a Curiosity to Learn:

- There is a pathway from simple to complex problems
- Tedium is reduced.
- Spend more time thinking about the core science.