CAREER: Multifidelity Modeling and Search Using Adaptive Field Prediction

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A variety of high-fidelity simulations are available in support of analysis and design optimization of engineered systems.

• Computational demands often mean advanced design techniques are not used to their fullest potential.

Motivation
Research idea

- How can the simulation prediction fields be used to enable the solution of new problems?

engineded device \[\xrightarrow{\text{predicted fields}}\]

state of the art

- extract QoI
- construct multifidelity models of the QoI

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- extract field features
- construct multifidelity models of the fields
- calculate QoI
One proposed approach

- Scientific machine learning (SciML) utilized for field regression
- Fuse $s$-levels of SciML information with multifidelity methods
Research plan

• Derive and characterize the approaches on engineering problems:

<table>
<thead>
<tr>
<th>Structural systems</th>
<th>Nondestructive testing systems</th>
<th>Fluid systems</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>FEA of structures</em></td>
<td><em>Measurement simulations</em></td>
<td><em>Internal/external CFD</em></td>
</tr>
<tr>
<td><em>Strain field</em></td>
<td><em>Acoustic wave/eddy current fields</em></td>
<td><em>Flow field</em></td>
</tr>
</tbody>
</table>

- **Test central hypothesis using other engineering problems:**

- **Microwave devices**
  - electromagnetic simulation & design
  - fabrication
  - anechoic field measurements
  - post-processing
Thank you!