Comments to the Presidential Advisory Committee on High Performance Computing and Communications, Information Technology, and the Next Generation Internet

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By

John Guckenheimer

President

Society for Industrial and Applied Mathematics
(SIAM)

Computational Science Vision

- Computer models are central to science and engineering. The implement theory in a quantifiable, testable fashion.

- Computation enables the construction, simulation and analysis of complex systems
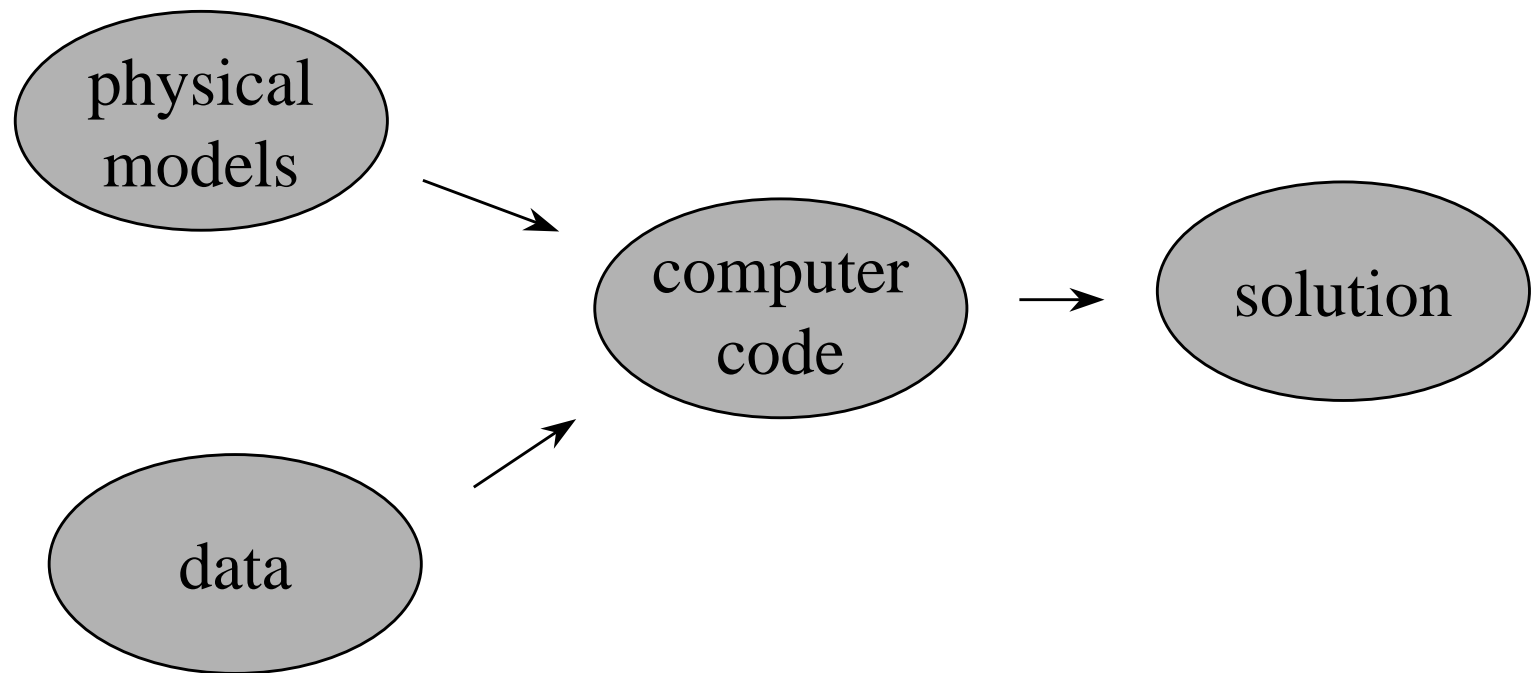
Impact of Computation

- Economic: improved design, shorter development cycles, industrial processes …
- National security: weapon systems, surveillance, stockpile stewardship
- Social systems: GPS, weather forecasts, air traffic control

Conventional view

Computation vs. reality

- Essential "physics" lacking in models
- Incomplete or inaccurate data
- Inadequate resolution
- Algorithms fail
- Results highly sensitive to input data

Observations

- Computation makes models useful
- Numerical and combinatorial analysis are foundations of computation
- Multiple disciplines are important
- Complex problems have complex input
- "High end" hardware is expensive
- Standards are important, rigidity is limiting

Recommendations

- Establish niches for numerical analysis
- Document economic importance of computation in industry
- Foster development of innovative numerical software
- Focus research programs upon individual creativity