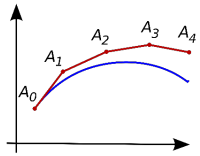
Formally Verified Numerical Methods

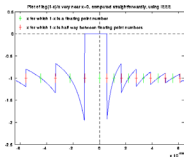
VeriNum

Challenge:

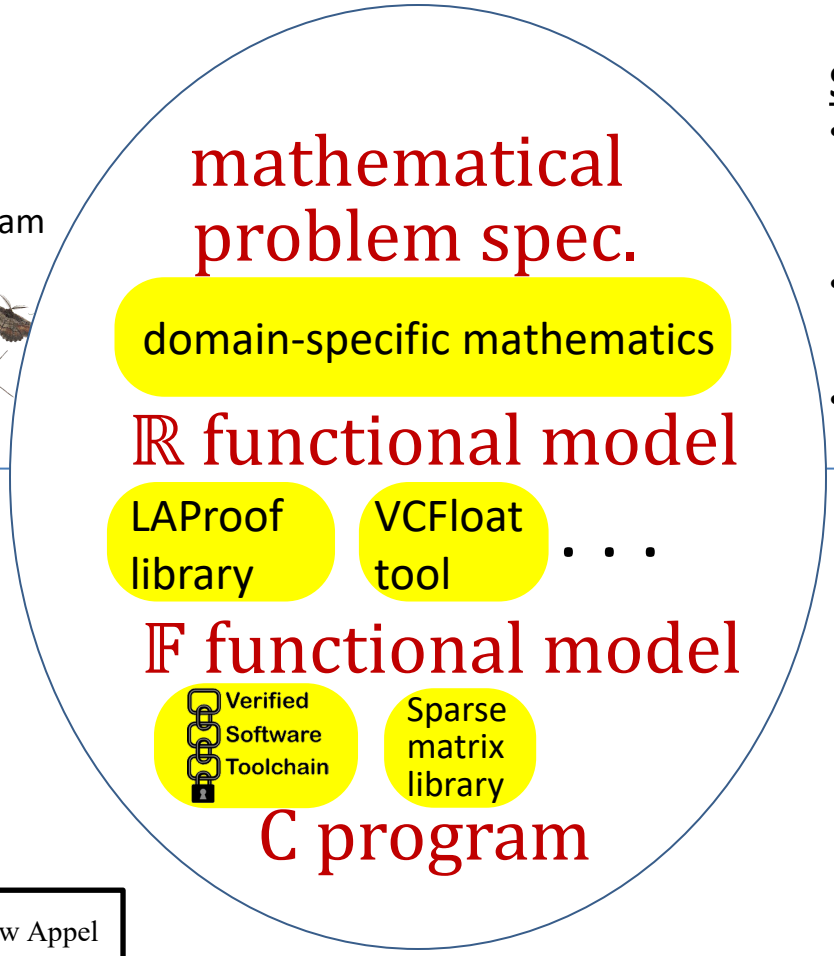
Discretization Error



Round-off error



Program bugs



Solution:

- End-to-end proofs in Coq
- Layered & modular
- New libraries, new tools, analysis algorithms

CCF-2219757 Princeton University, Andrew Appel
CCF-2219758 Cornell University, David Bindel

Scientific Impact:

- Connect the mathematical theory of numerical analysis to machine-checked formal methods.
- Demonstrate layered modular approach to formal-methods community
- Validate results and methods in computational science

Broader Impact and Broader Participation:

- Primary impact: scientific/engineering computation
- Transition to practice: verified libraries
- Outreach: invited talk at 2025 International Workshop on Verification of Scientific Software