

High-Assurance Autonomous Nuclear Reactor Control with Emerson Ovation

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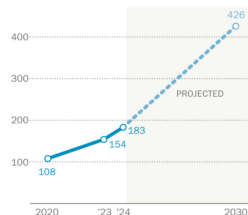
Goal: Develop autonomous hybrid control systems with mathematical guarantees of safe and correct behavior that lower operating costs for nuclear power.

Problem:

Nuclear power is ideal for future energy needs, but is expensive.

Electricity consumption at U.S. data centers is expected to more than double by 2030

Total electricity consumption by U.S. data centers (terawatt-hours)



Source: Pew Research Center, Data from IEA

Source	Total (\$/MWh)	O&M (\$/MWh)
Adv. Nuclear	88.24	18.50
Natural Gas	39.00	2.90

Source: EIA Annual Energy Outlook 2022

Solution:

To reduce operating costs, we will build autonomous controllers that are correct by construction.



Synthesizing
Procedures with
Formal Methods



Discrete Automata
and Control Theory



Safe & Secure
Autonomous
Controllers

Proof:

To reach TRL 5, we will build a demonstration using hardware-in-the-loop (HiL) simulation with an Emerson Ovation control system.



Ovation-Based
Controller
Realization



ARCADE HiL
Interface



Simulated Nuclear
Power Plant