



Established by the European Commission



ERC Advanced Grant

"FAULT-ADAPTIVE" Monitoring and Control of Complex Distributed **Dynamical Systems**

Pioneering research to improve the performance and fault tolerance

of Critical Infrastructure Systems

Critical Infrastructure Systems (CIS) are crucial for everyday life and well-being

- Citizens rely on their availability (24/7) and their efficient management at low cost
- CIS do fail (e.g. blackouts), either due to accidental failures (equipment failures, human error, software bugs) or malicious attacks (directly, remotely)
- This has tremendous consequences (Societal consequences, Health hazards, Economic effects)



- Managing CIS is becoming more and more difficult due to:
 - Increasing size and complexity
 - Heterogeneity and distributed nature (many decision makers)
 - Interconnectedness and inter-dependence (cascading effects between them)
- Several things can go wrong!
 - Sensors/components may fail
 - Data may be corrupted or missing
 - Information may be inconsistent

Interdependent systems that work together to provide the essential services of a modern society

- The normal operation of water supply and telecommunications requires the steady supply of electric energy
- The generation and delivery of electric power relies on the provision of fuel, water, and various telecommunications for data transfer and control of the power plants and networks
- Brief power outages may result in traffic congestion, or worse, in fatal accidents

Need to develop intelligent data processing methods for monitoring and control





FAULT-ADAPTIVE

Design and analysis of "smart" and adaptive algorithms for real-time data processing, capable of improving the performance and fault tolerance of critical infrastructure systems

- Learn characteristics or system dynamics
- Adapt to unforeseen scenarios
- Predict missing or inconsistent data
- Exploit spatial and temporal correlations between variables ullet
- Prevent "small" fault events from escalating into major failures
- Process huge and complex volumes of data (Big Data)

Benefit from Computational Intelligence area to develop advance tools

- Humans have a great ability to understand and react to various uncertain and highly unstructured situations
- Processing redundant sensory information and learning from past experience
- Machines, on the other hand are required to process huge amount of data from distributed sensors and to make real-time control decisions, relying on the correct operation of components
- Help machines to develop an intuitive perception of the quality of the received sensory data and improve the quality of their decisions/actions

High impact investment: Potential to create new products/companies, **Employment of high quality researchers**

Project details

- Principal Investigator: Prof. Marios M. Polycarpou •
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