Modeling

Data-driven approaches for modeling

Structuration

Modeling for verifiability – long-term
Integrated hierarchy of abstractions from initial design to implementation
Mechanisms for composition/composability
Modularity, hiding component information for hybrid systems

Representations

Expressing opaque components
Modeling/conceptualization languages
Programming language(s) for CPS
Domain specific languages for CPS

Methods

Integrating analysis into the design process
Correct by construction
Transferring model-based results to the running system
Dealing with imprecision (e.g., failures, sensor & computational errors)
Stochastic systems
Combining symbolic & numerical approaches for verification & design
Automating generating dependability

Tools

Formal methods for legacy systems
Unified tool set w/ standardized inputs & better visualization for delivering outputs
Usability of CPS verification tools (automation, understand results)
Translation of specifications between tools
Tools for making it possible to retain information/tracability at all levels

**CPS Domains/issues/problematiques**

CPS with human in the loop
CPS at scale (spatial and temporal)
Communication issues-distributed (e.g., IOT)
Multi-agent CPS
Characterizing important properties in applications & logics
Dealing with adaptive & autonomous systems (safety)
Control problems in the CPS framework
Definitions of security for CPS
Privacy in distributed systems
Energy, power, economic, ethical (para-functional) concerns
Systems engineering issues in CPS (more than just the software)

**Education**

Education in CPS, engaging domain experts/end users
Designing course to create excitement about CPS
CPS projects
Tools that students can use

**Tech transfer**
Packaging formal methods for practitioners

Involvement in standards

Clearer/more transparent compositional V&V techniques for the user

Dialog with design and development people

**Evaluation**

Structured CPS competitions (like SMT Comp)

Metrics for conveying success and claims

Grand challenge(s) for CPS verification

Repeatability of research results