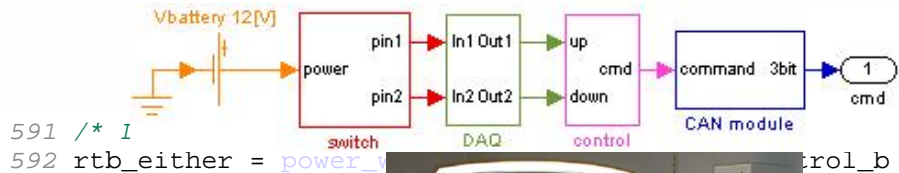
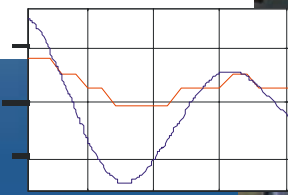


# Networked Embedded Systems



```

591 /* I
592 rtb_either = power_v
593 || power_window_con
594
595 /* Logic: '<S13>/al
596 * Inport: '<Root>/d
597 * Logic: '<S13>/over
598 */
599 rtb_temp34 = power_v
600 && (!(rtb_either));
    
```



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# Some Characteristics

- Uncertainty
  - Temporal behavior
    - Jitter
    - Latency
  - Ordering
    - Dynamic routing
  - Integrity
    - Interference
- Size
  - Huge state and event spaces
- ...

# Model-Based Design

- The power to predict
- Computational modeling
  - Different engineering domains
    - Software, control, communications, signal processing ...
  - Move between levels of abstraction
    - For example, less detail for ambient network traffic
  - Generative modeling
- Computational simulation
  - Combine dedicated solver technologies

# Computer Automated Multiparadigm Modeling (CAMPaM)

- Levels of abstraction
- Model transformation
- Domain specific languages
  - Make inherently secure
  - Elements
    - **Meta-models for concrete and abstract syntax**
    - **Graph transformation for semantics**
- Interface definition
  - “If we divide to conquer, we must reunite to rule” (Michael Jackson)
- Integration with physical realization

# Some Elements of a Roadmap

- Algorithms
  - Fault detection, isolation, reconfiguration
  - Nondeterminism
  - Scalable model checking
- Methodologies
  - Domain specific languages and tools
  - Automated modeling
  - Safety, diagnosability, and security built into the design
- Technologies
  - Integrating event-driven and time-driven simulation
  - Hardware acceleration
  - C code integration

# Education

- Provide cross-domain knowledge
  - Software engineering
  - Control system design
  - Communications technology
  - ...
- Include security elements in different courses
- Teach modeling and meta-modeling
  - How to model ... for simulation?
  - How to model changes in abstraction?
  - How to define a specific modeling language?
  - How to integrate with hardware (emulation)?
  - ...