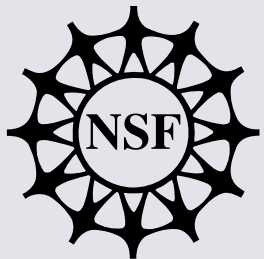
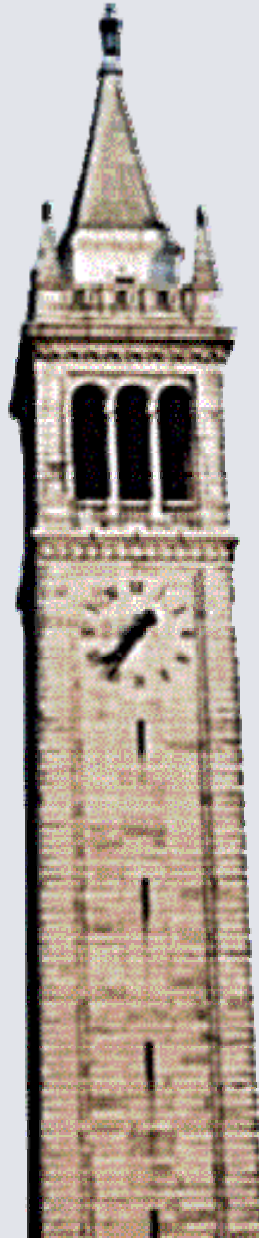


# Interchange Format for Hybrid Systems

Edited and presented by  
Alessandro Pinto  
UC Berkeley



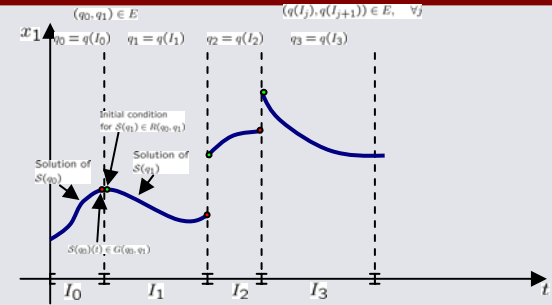
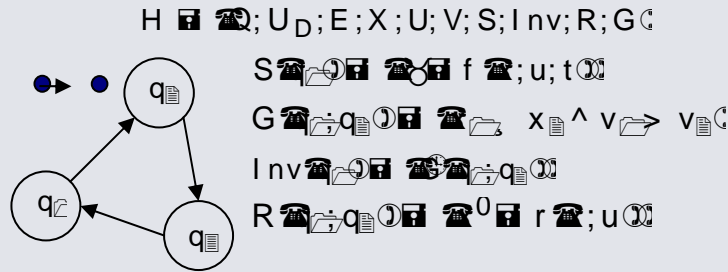
Chess Review  
November 21, 2005  
Berkeley, CA



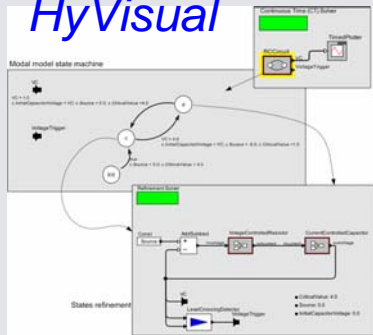
# Interchange Format: The big picture



## HS-Denotational Description



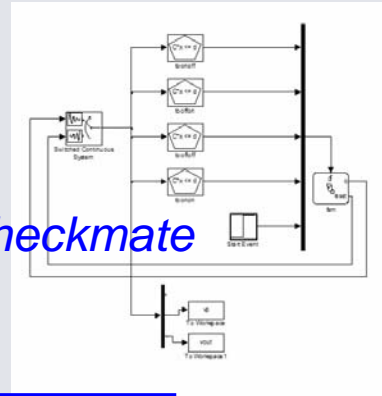
## HyVisual



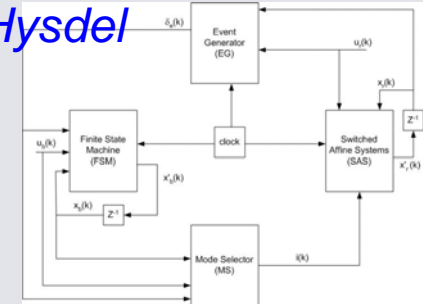
## Charon



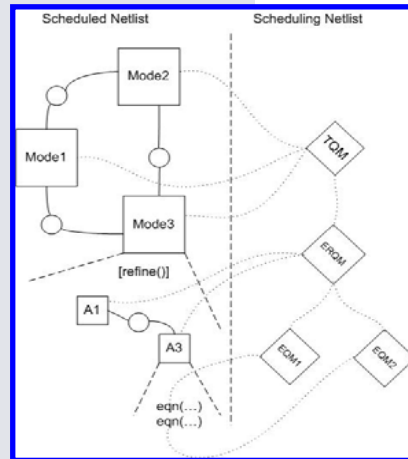
## Checkmate



## Hysdel



## Interchange Format



# Review of hybrid system design environments



Name	Automata Definition	State -> Dynamics Mapping	Supported Dynamics	Guards	Invariants	Reset Maps
Simuink/ Stateflow	Stateflow	Stateflow output selecting state evolution	No limitations	Conditions on Stateflow inputs and Th. Crossing detectors	Not supported	Reset of integrators from Stateflow outputs
Modelica	Implicit	Events enabling equations	No limitations	Triggering conditions on state variables	Not an explicit language feature	Reinit statements
HyVisual	Explicit FSM representation	Discrete state refinement	No limitations	Triggering conditions on state variables	Not supported	Assignment on the FSM edges
Scicos	Implicit using threshold and switches	Events switching dynamics	No limitations	Threshold detectors	Threshold detectors	Re-initialization of integrators
Shift	Text-based definition of locations and transitions	Flows as location arguments	No limitations	Conditions on system variables	Conditions on system variables	Assignment statements
Charon	Mode composition and refinement	Differential and algebraic constraints inside modes	No limitations	Enabling conditions on system variables	Constraints on system variables	Assignment statements
HyTech	Explicit declaration of locations and transitions	Flows defined in each location	Predicates on derivative variables	Convex predicates on system variables	Convex predicates on system variables	Assignment statements
Checkmate	Stateflow	Mode selector from stateflow to a set of dynamics	Linear or non linear	Affine inequalities	Not supported	Affine maps
d/dt	Explicit declaration of locations and transitions	Flows defined in each location	Linear	Convex predicates on state variables	Convex predicates on state variables	Not supported
Hysdel	Logic formulas on boolean variables	Mode selectors	Discrete time and linear	Threshold conditions on system variables	Not supported	Modeled as one step dynamics



# Review of hybrid system design environments



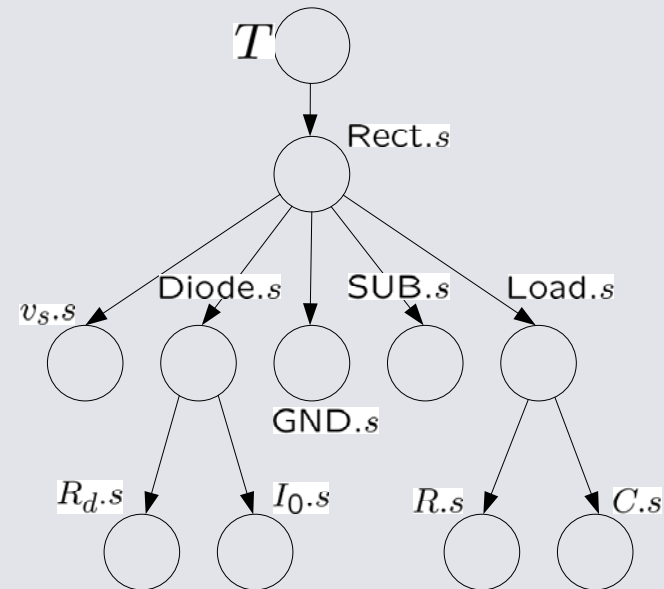
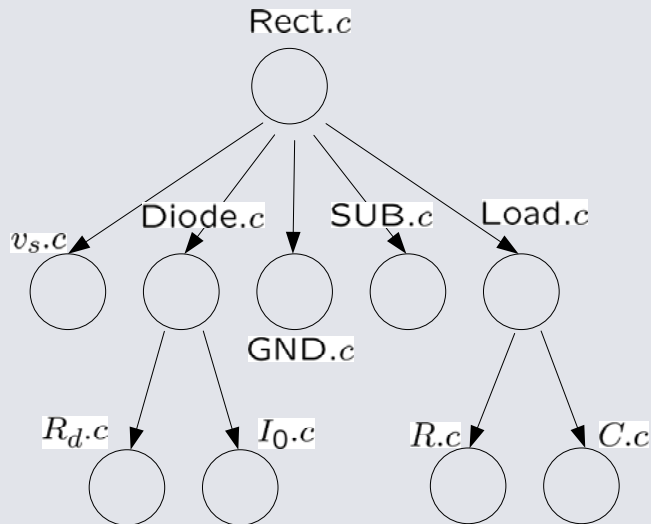
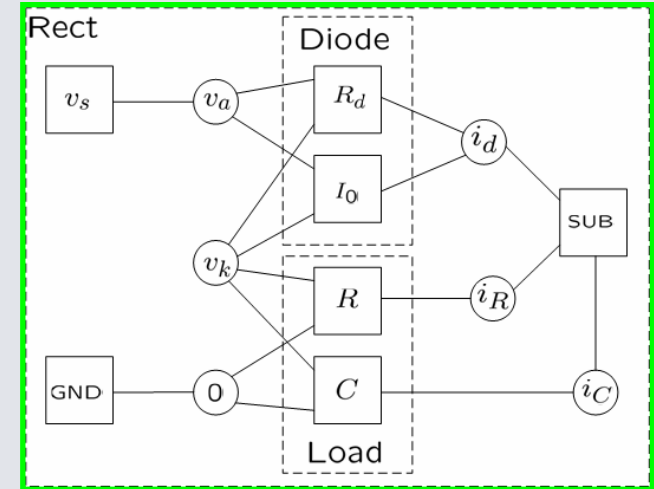
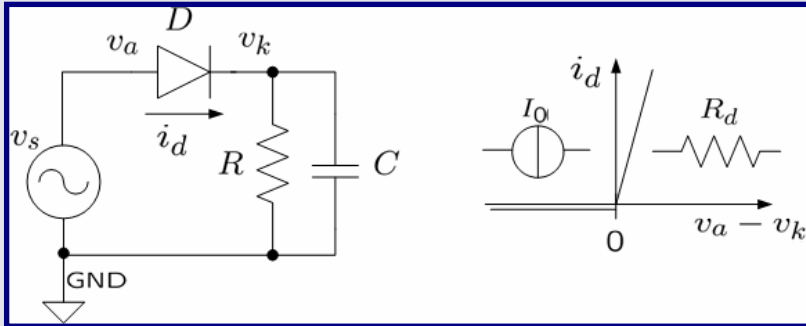
Name	Hierarchy	Composition	OO	Causality	Algebraic Loops	Dirac Pulses	Continuous/Discrete Interface
Simuink/ Stateflow	Y	Continuous variables (Simulink) and discrete events (stateflow)	N	Causal	Explicit Algebraic loop solver	N	Stateflow acting on Simulink blocks
Modelica	Y	Connection Statements	Y	Non causal components and causal functions	Simulator dependent	N	Events enabling equations
HyVisual	Y	Ports exposing internal variables	Y	Causal	Not Supported	N	States refined into dynamical systems
Scicos	Y	Continuous and discrete variables	N	Causal	Not Supported	N	Discrete states affecting continuous states
Shift	Y	Continuous variables and event synchronization	Y	Causal	Not Supported	N	Flows associated to locations and reset maps
Charon	Y	Connection of agents variables	N	Causal	Not Supported	N	Modes declaring differential/algebraic constraints
HyTech	N	Synchronization of automata	N	Causal	Not Supported	N	Flows associated to locations and reset maps
Checkmate	N	N	N	Causal	Not Supported	N	Mode selectors switching dynamics
d/dt	N	N	N	Causal	Not Supported	N	Flows associated to locations
Hysdel	N	N	N	Causal	Not Supported	N	Mode selectors switching dynamics



# Interchange Format



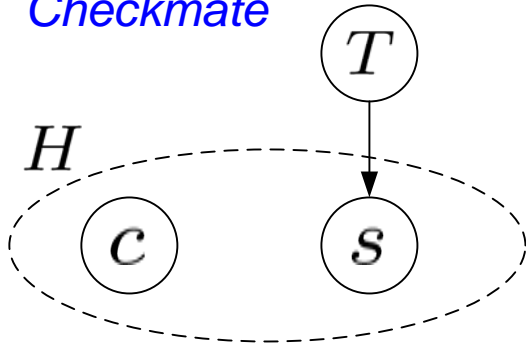
(A. Pinto, L.P. Carloni, R. Passerone, A.L. Sangiovanni Vincentelli  
 "Interchange Format for Hybrid Systems: Abstract Semantics"  
 Submitted to HSCC 2006)



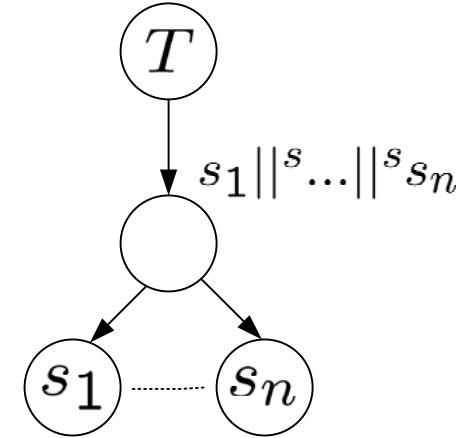
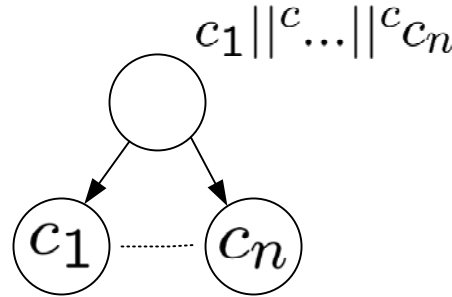
# Structure of existing languages



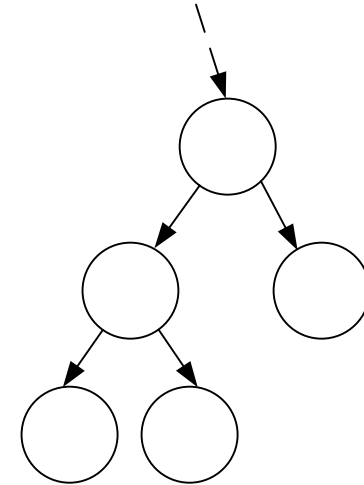
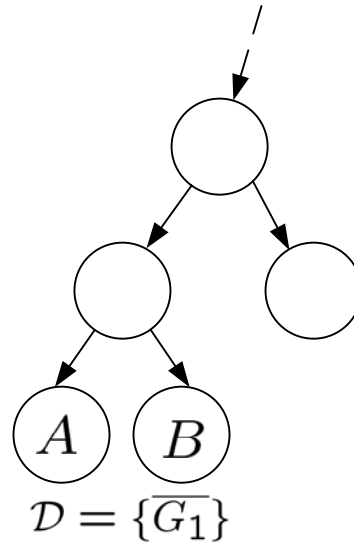
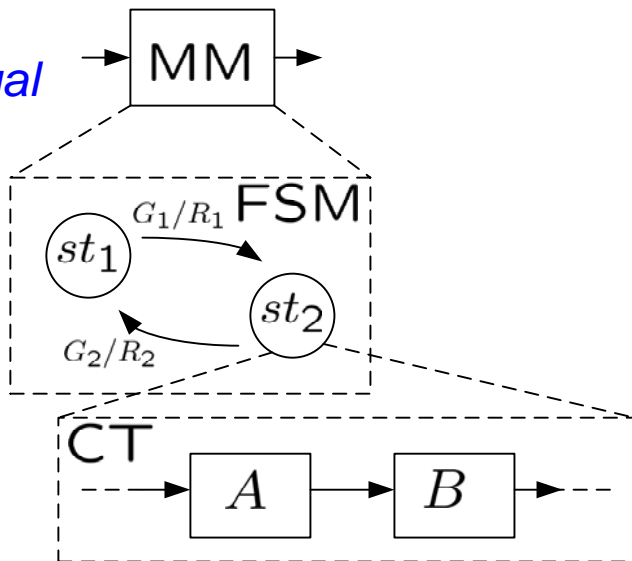
Checkmate



HSIF/HyTech



HyVisual





A screenshot of a Mozilla Firefox browser window. The title bar reads "Alessandro Pinto: Research -> Interchange Format for Hybrid Systems - Mozilla Firefox". The address bar shows the URL "http://www.eecs.berkeley.edu/~apinto/interchangeformat.html". The page content includes a section titled "Code Examples" with a paragraph: "We have used the **Metropolis** framework to demonstrate how the interchange format captures a hybrid system. An example of a half-wave rectifier can be downloaded **here**." Below this is a "Publications" section with three entries:

- Luca Carloni, Maria D. Di Bebedetto, Alessandro Pinto and Albert Sangiovanni-Vincentelli  
**Modeling Techniques, Programming Languages Design Toolsets and Interchange Formats for Hybrid Systems**  
*Columbus Project, DHS3*
- Alessandro Pinto, Alberto Sangiovanni-Vincentelli, Roberto Passerone and Luca Carloni  
**Interchange Formats for Hybrid Systems: Review and Proposal**  
*Hybrid Systems: Computation and Control, Zurich, Switzerland 2005*
- Jonathan Sprinkle, Aaron D. Ames, Alessandro Pinto, Haiyang Zheng, Shankar Sastry  
**On the Partitioning of Syntax and Semantics for Hybrid Systems Tools**  
*44th IEEE Conference on Decision and Control*

The browser's status bar at the bottom shows "Done" and a row of system icons including a smiley face, a green circle, and several weather icons.

