Virtual Talk Series – DES Tools – CIF

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CIF supports synthesis-based engineering of supervisory controllers

Supervisory controllers

- Cyber-physical systems, e.g., X-ray systems, lithography systems, industrial printers, waterway locks
- More and more complex control software (the cyber part), to ensure correct and safe behavior

Synthesis-based engineering (SBE)

- Combines model-based engineering with computer-aided design
- Synthesize correct-by-construction controllers, using hyper-automation

Main benefits

- Better quality controllers
- Reduced engineering effort
- Supports large industrial systems

by reducing human error by focusing on what is essential by efficient controller engineering

For more information: <u>https://eclipse.org/escet/cif/synthesis-based-engineering</u>



CIF language

CIF is a powerful declarative modeling language for the specification of discrete event, timed, and hybrid systems as a collection of synchronizing automata

Finite state machines

- Automata
- Synchronizing events
- Point-to-point channels
- Non-determinism
- Monitors

Support for large systems

- Automaton definitions/instantiations
- Groups (+ definitions/instantiations)
- Imports

Extended finite state machines

- Data (variables, guards, updates)
- Discrete variables
- Algebraic variables (+ equations)
- Input variables
- Constants
- Rich built-in data-types
- Custom types / type declarations
- Initialization predicates
- Invariants
- Functions (also as data)

For more information: https://eclipse.org/escet/cif/language-tutorial

Timed state machines

- Time variable
- Continuous variables (+ equations)
- Urgency concepts

Other extensions

- Supervisory controller synthesis
- Stochastics
- SVG visualization/interaction
- Print output



CIF tools

The CIF tooling supports the entire development process of controllers

Specification

- Textual editor
- Conversion to yEd diagrams

Supervisory controller synthesis

- Data-based synthesis
- Event-based synthesis
- Conversion to Supremica

Simulation, visualization and validation

- Interactive simulation
- Automated simulation
- Powerful visualization features

Verification

- Controller property checker
- Conversion to mCRL2
- Conversion to UPPAAL

Implementation

- PLC code generation
- Java code generation
- C and Simulink code generation

Other

- State space generator (explorer)
- CIF to CIF transformations
- Merger
- Event disabler

For more information: <u>https://eclipse.org/escet/cif/tools</u>

CIF in action









CIF is ready to use

Long history

- 30+ years of academic and applied SBE research
- 15 years of CIF language/tool development (origin at TU/e)

Mature and proven technology

- Thoroughly tested tools
- Extensive documentation
- Successful case studies in many domains
 - E.g., healthcare, automotive, infrastructure, semiconductor
- Proven real-world maturity
 - E.g., car drove in real traffic (cruise control)
 - E.g., bridge passed site acceptance test



For more information: <u>https://eclipse.org/escet/cif</u>



CIF is developed as part of the Eclipse ESCET open-source project

Eclipse ESCET project

- An Eclipse Foundation project since 2020
- Home to CIF, and some other tools (Chi and ToolDef)
- Learn more at: <u>https://eclipse.org/escet</u>

Download for free

- Eclipse ESCET IDE and command line tools
- Windows, Linux, macOS
- Portable: extract and use

Active development

- Quarterly releases
- 100+ end user visible improvements and fixes since April 2021

You can get started today!

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