

Model Clone Detection in Practice

Florian Deissenboeck, Benjamin Hummel
Elmar Juergens, Michael Pfaehler

Bernhard Schaetz

Technische Universität München

fortiss gGmbH



```

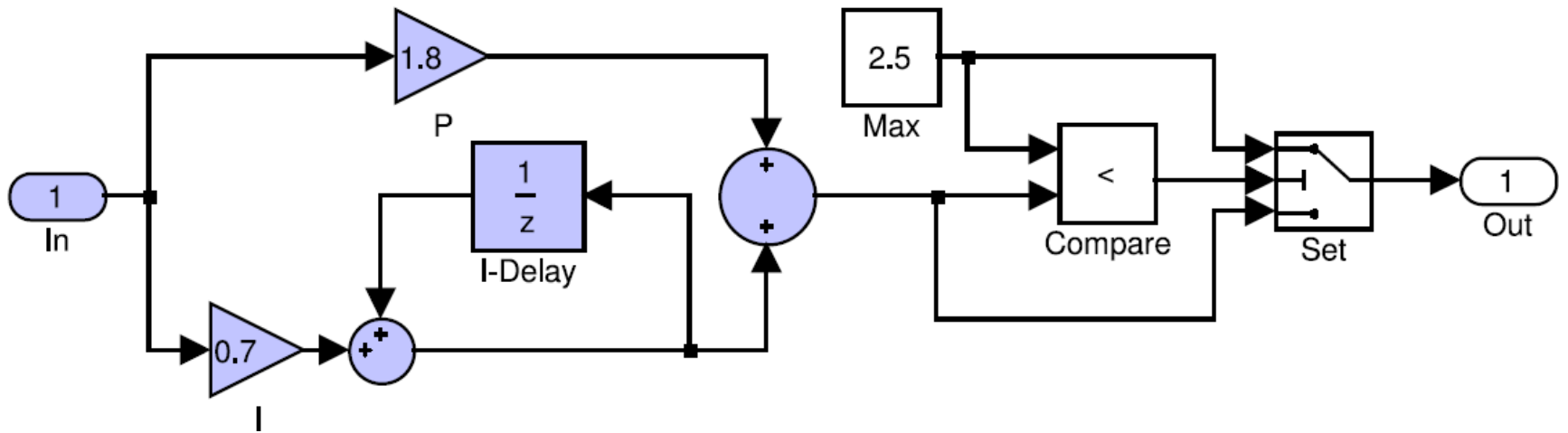
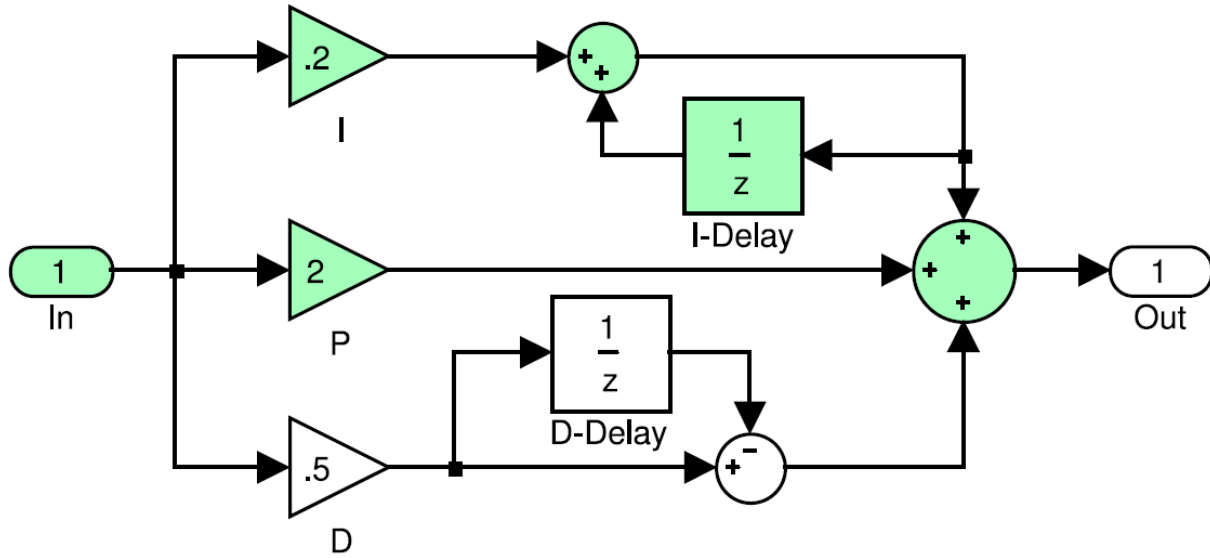
// Utilities for arrays of elements
public String showElements(ModelElement[] elements, String nomsg) {
    boolean found = false;
    StringBuffer res = new StringBuffer();
    if (elements != null) {
        Index.getInstance().setCurrentRenderer(
            FlatReferenceRenderer.getInstance());
        for (int i = 0; i < elements.length; i++) {
            ModelElement el = elements[i];
            res.append(showElementLink(el)).append(HTML.LINE_BREAK);
            found = true;
        }
        Index.getInstance().resetCurrentRenderer();
    }
    if (!found && nomsg != null && nomsg.length() > 0) {
        res.append(HTML.italics(nomsg));
    }
    return res.toString();
}

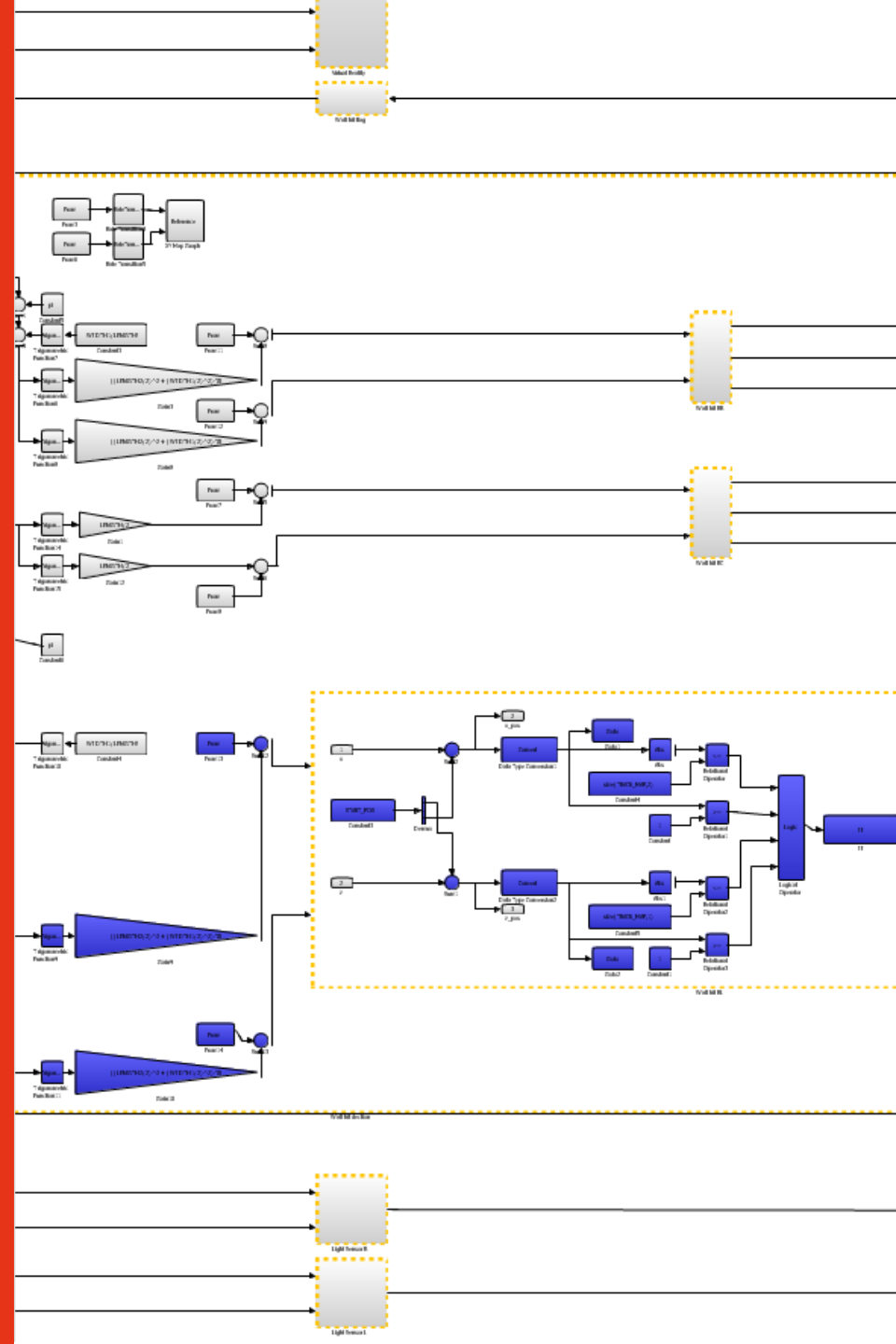
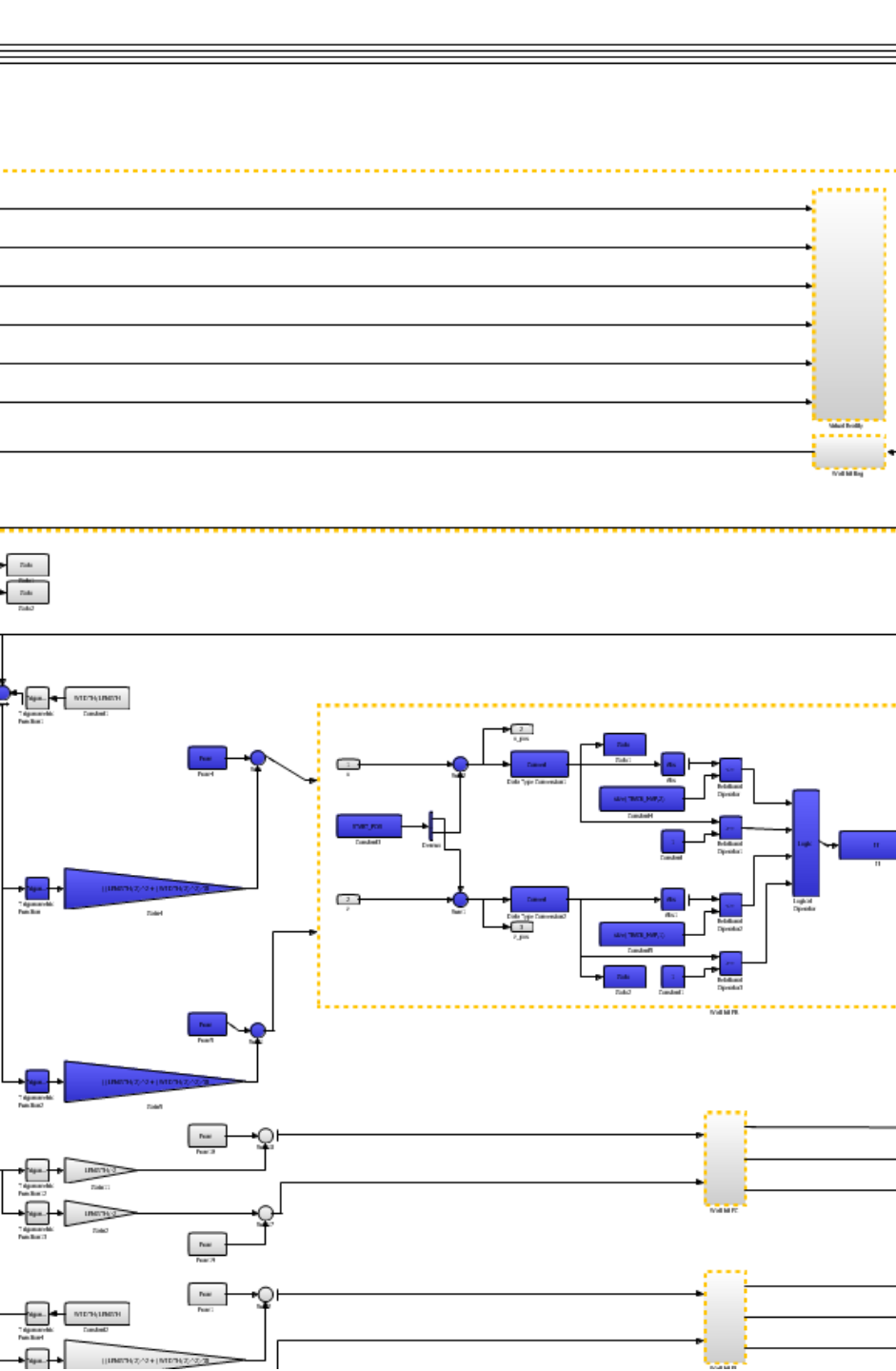
```

```

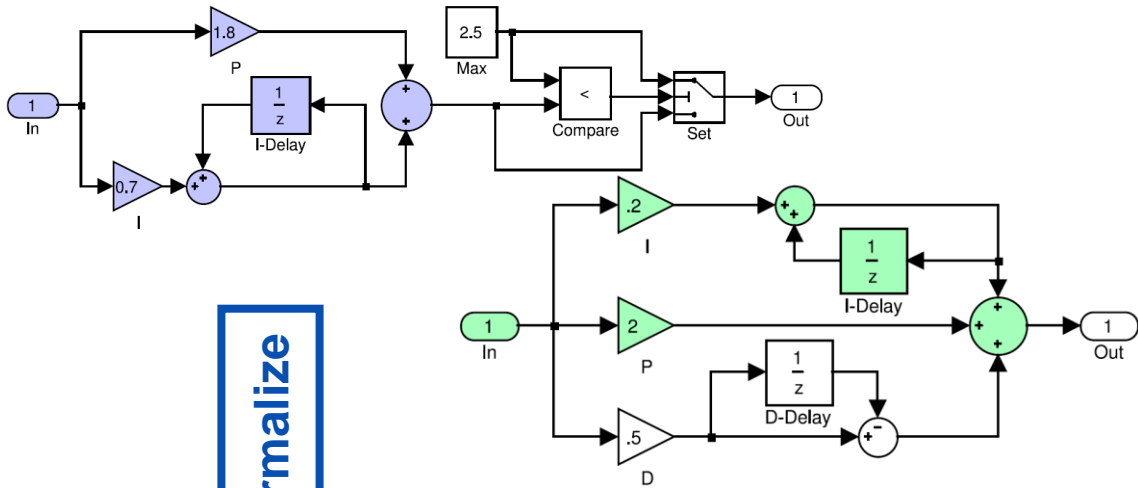
// Utilities for arrays of elements
public String showElements(ModelElement[] elements, String nomsg) {
    boolean found = false;
    StringBuffer res = new StringBuffer();
    if (elements != null) {
        Index.getInstance().setCurrentRenderer(
            FlatReferenceRenderer.getInstance());
        for (int i = 0; i < elements.length; i++) {
            ModelElement el = elements[i];
            res.append(showElementLink(el)).append(HTML.LINE_BREAK);
            found = true;
        }
        Index.getInstance().resetCurrentRenderer();
    }
    if (!found && nomsg.length() > 0) {
        res.append(HTML.italics(nomsg));
    }
    return res.toString();
}

```



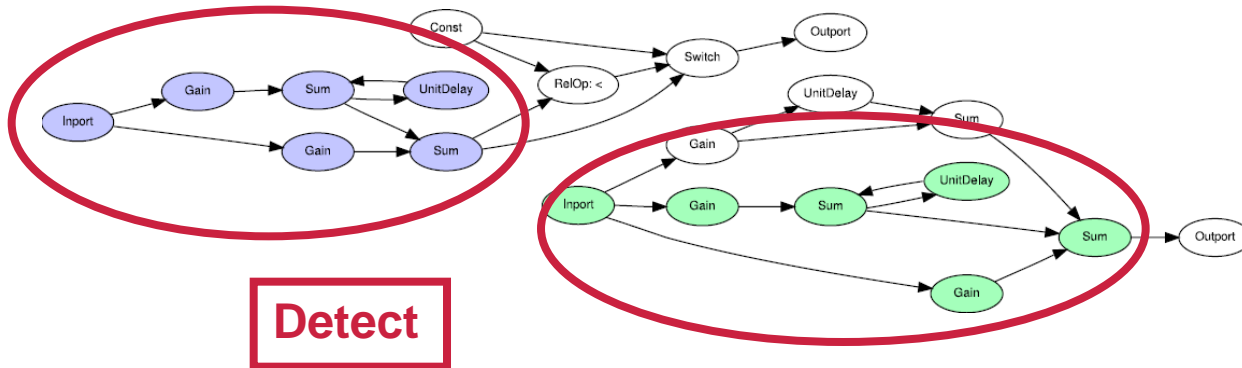


Detection Steps



Load Model

Normalize



Detect

Report

Existing Work

Deissenboeck et. al. [ICSE'08]

**First detector and
MAN case study**

Pham et. al. [ICSE'09]

Nguyen et. al. [FASE'09]



Different detection algorithm

Huhn et. al. [MBEES'10]

Application to SCADE models

Challenges in Practice

Scalability

Relevance

Inspection

Scalability

Publicly available
(Matlab Central)

Model	# Nodes	# Edges
SIM	428	415
MUL	475	576
SEM	1,741	2,029
ECW	2,312	2,274
MPC	369	395

“Real-World” (BMW)

Algorithmic Tricks

Cloned Subsystem Removal (CSR)

[Pham+09]

Splitting at High-Degree Nodes (HDN)

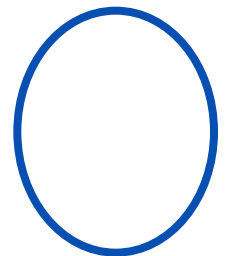
[Pham+09]

Reduced Branching Heuristic (RBH)

[DHJ+08]

Runtime Results

	C	H	R
	S	D	B
	R	N	H
eScan [Pham+09]			
eScan [Pham+09]	✓		
eScan [Pham+09]		✓	
eScan [Pham+09]	✓	✓	
ConQAT [DHJ+08]			✓
ConQAT [DHJ+08]	✓		✓



“...more than half of the clones found are obviously clones according to our definition but would not be considered relevant by a developer.”

MAN case study [DHJ+08]

Improving Relevance

Different notion of clone?
(not isomorphism)

Different normalization?

Domain-specific metrics for
ranking/filtering clones!

Metrics

Deviation for ranking 21 clones
(worst 220, average 146)

	Developer 1	Developer 2
Node Size	139	163
Clone Weight	157	183
Relative Weight	110	90
Interface/Weight	86	90
Interface/Node Size	123	123

Deviation between
developers: 74

Inspection: Tool Support

The screenshot displays the Eclipse IDE interface for the ConQAT tool. The main window shows a UML diagram with several clone groups highlighted by dashed yellow boxes. The Finding Groups View in the bottom-left corner provides a table of these clone groups.

Description	Size	size	weight	grou...	if...
Clone Group 30	11	10.0	8.0	88.0	0.0
Clone Group 25	10	26.0	19.0	190.0	0.0
Clone Group 28	9	24.0	19.0	171.0	0.0
Clone Group 1	5	2.0	2.0	10.0	0.0
Clone Group 21	5	11.0	9.0	45.0	0.0
Clone Group 9	4	31.0	24.0	96.0	0.0
Clone Group 16	2	32.0	25.0	50.0	0.0
Clone Group 15	2	18.0	14.0	28.0	1.0
Clone Group 18	2	28.0	21.0	42.0	0.0
Clone Group 17	2	18.0	7.0	14.0	0.0

The Finding Groups View also includes a table for messages:

Name	Message
ConQAT Model ...	
ConQAT Model ...	
ConQAT Model ...	
ConQAT Model ...	

The main diagram area shows a complex UML diagram with various components and relationships. The clone groups are highlighted with dashed yellow boxes, indicating the tool's ability to identify and inspect these groups. The interface includes a Package Explorer on the left, a Hierarchy view, and a Finding Groups View at the bottom left. The status bar at the bottom indicates the current page is 37M of 69M.

Summary

Ingredients for practical application:

(not only for model clones)

- **Scalability**
- **Relevance**
- **Inspection/Tooling**

**Working on all three of them,
but none is „solved“ yet :-)**

What should be the clones?

