Department of Computer Science
Research Focus
"Intelligent Formal Systems"

TECHNISCHE UNIVERSITÄT DRESDEN

Colloquium

Within the seminar of the Research Focus, the Ph.D. programme "Specification of discrete processes and systems of processes by operational models and logics" presents a talk by

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about

"Pebble Tree Transducers, Tree-Walking and Alternating Tree-Walking Automata"

Abstract: The n-pebble tree transducer (shortly n-ptt) was proposed as a formal model for XML query languages by Tova Milo, Dan Sucio and Victor Vianu in 2000. We consider the version introduced by Joost Engelfriet and Sebastian Maneth in 2002. It is a finite state device that translates ordered ranked trees. Its reading head is a pointer to a node of the input tree and can be moved along the edges of the input tree. The n-ptt is equipped with n pebbles, marked $1, \ldots, n$, which can be dropped at and lifted from the current node. We denote the tree transformation induced by n-ptt M with τ_M. During the computation, the positions of dropped pebbles may serve extra information, and with increasing the value of n, the transformation capacity of n-pebble tree transducers also increases. So $0\text{-}PTT \subset 1\text{-}PTT \subset 2\text{-}PTT \subset \cdots$, where $n\text{-}PTT$ means the class of n-pebble tree transformations. We note that $0\text{-}PTT = ATT$, where ATT is the class of attributed tree transformations first defined in 1981 by Zoltán Fülöp.

There are many open problems left related to pebble transducers, which are waiting for answer. Some of them are the followings.

- Is the circularity of n-ptts decidable?
- Is the equivalence problem decidable for 0-ptts? (0-ptts M_1 and M_2 are equivalent, if $\tau_{M_1} = \tau_{M_2}$.)
- Is the emptiness of τ_M decidable for n-ptt M?

Now we are going to give answer for the latest open question in a special case. We need a finite state device that is able to simulate the behaviour of an n-ptt concentrating only on the input trees. This device is called *n-pebble alternating tree-walking automaton* (or shortly *n-patwa*). An n-patwa recognizes a tree language. We can easily derive a patwa from every ptt preserving determinism and non-circularity, such that the patwa recognizes the domain tree language of the given ptt.

Our main result is that the tree language recognized by a deterministic and non-circular n-patwa is effectively regular. It means that for every n-patwa we are able to construct a (classical) tree automaton recognizing the same language. We have got the corollary that the domain tree languages of deterministic and non-circular n-ptts are effectively regular. So we can decide everything for the domains of deterministic and non-circular n-ptts that is decidable for regular tree languages, including the emptiness problem. Thus, in the special case, when an n-ptt M is deterministic and non-circular, it is decidable, if $\tau_M = \emptyset$ or not. Answering the open question for the circular and/or nondeterministic case needs further and more insightful investigations.

Date:	26.04.2005
Place and time:	Willersbau, Room: WIL C129, 1.15 pm

All interested persons are invited to attend!

Prof. Dr.-Ing. habil. Heiko Vogler