

Eco-colonies

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Eco-colonies

Two years ago eco-colonies have existed only as a motivation,
now my work is

- ✓ to define them exactly,
- ✓ to find their properties and possibilities of usage.

Origin of eco-colonies

- ✓ based on colonies with inspiration on eco-grammar systems,

Origin of eco-colonies

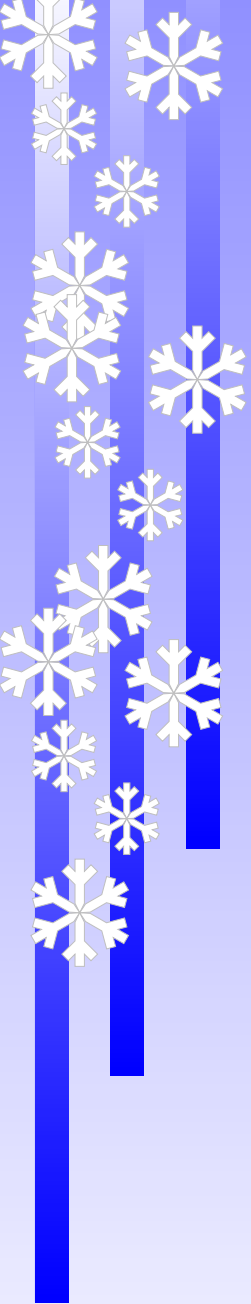
- ✓ based on colonies with inspiration on eco-grammar systems,
- ✓ eco-colonies:
 - ★ simple grammars (agents, components) – as in colonies,
 - ★ self-developing environment – as in eco-grammar systems,

Origin of eco-colonies

- ✓ based on colonies with inspiration on eco-grammar systems,
- ✓ eco-colonies:
 - ★ simple grammars (agents, components) – as in colonies,
 - ★ self-developing environment – as in eco-grammar systems,
- ✓ two types:
 - ★ 0L eco-colonies with one main alphabet (the environment is 0L-scheme) – as in eco-grammar systems,
 - ★ E0L eco-colonies with two alphabets (a main and a terminal, the environment is E0L-scheme) – as in colonies.

Eco-colonies

= model of a community of cooperating processes, grammar system





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- ✓ *word* – some of states of the environment,

Eco-colonies

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- ✓ *symbols* – elements of the alphabet, objects,
- ✓ *environment* – contains symbols, the environment is self-developing,
- ✓ *word* – some of states of the environment,
- ✓ *agents (components)* – cooperating grammars, processes, subjects, working parallelly,
 - ★ *start symbol* – what the agent can process, it looks for this symbol in the environment,
 - ★ *language of the agent* – what the agent can do with its start symbol, the agent replaces it by some word of this language.

Eco-colonies – example

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- ✓ *environment* – meadow, the development means growth of grass, the pieces of soil without grass are (or are not) replaced by the grass-blades,

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- ✓ *symbols* – {grass-blade, piece of soil without grass},
- ✓ *environment* – meadow, the development means growth of grass, the pieces of soil without grass are (or are not) replaced by the grass-blades,
- ✓ *word* – state of the meadow,
- ✓ *agents* – hungry rabbits,
 - ★ *start symbol* – grass-blade,
 - ★ *language of the agent* – piece of soil without grass (the rabbit eats the grass-blade).

0L eco-colonies – definition

An 0L eco-colony of degree n , $n \geq 1$, is an $(n + 2)$ -tuple $\Sigma = (E, A_1, A_2, \dots, A_n, w_0)$, where

- ✓ $E = (V, P)$ is 0L scheme, where
 - ★ V is a finite non-empty alphabet,
 - ★ P is a finite set of 0L rewriting rules over V ,
- ✓ $A_i = (S_i, F_i)$, $1 \leq i \leq n$, is the i -th agent, where
 - ★ $S_i \in V$ is the start symbol of the agent,
 - ★ $F_i \subseteq (V - \{S_i\})^*$ is a finite set of action rules of the agent (the language of the agent),
- ✓ w_0 is the axiom.

E0L eco-colonies – definition

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- ✓ $E = (V, T, P)$ is E0L scheme, where
 - ★ V is a finite non-empty alphabet,
 - ★ T is a non-empty terminal alphabet, $T \subseteq V$,
 - ★ P is a finite set of E0L rewriting rules over V ,
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Eco-colonies – derivation modes

Only parallel derivation modes, the basic derivation mode is

weakly parallel derivation mode (wp)



Eco-colonies – derivation modes

Only parallel derivation modes, the basic derivation mode is

weakly parallel derivation mode (wp):

- ✓ all agents work parallelly,
- ✓ every agent which can work must work,
- ✓ if an agent does not find any free occurrence of its start symbol, it is resting for this derivation step.

Eco-colonies – example

$$L_1 = \{a^{2^i} \mid i \geq 0\} \cup \{b^k c^k b^n c^n \mid k, n \geq 1\}$$

$\Sigma = (E, A_1, A_2, A_3, A_4, A_5, S)$, where

$E = (\{S, P, Q, a, b, c\}, \{a, b, c\},$

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$A_1 = (S, \{a, PP\})$

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$S \xrightarrow{wp} a$

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$S \xrightarrow{wp} a \xrightarrow{wp} aa$

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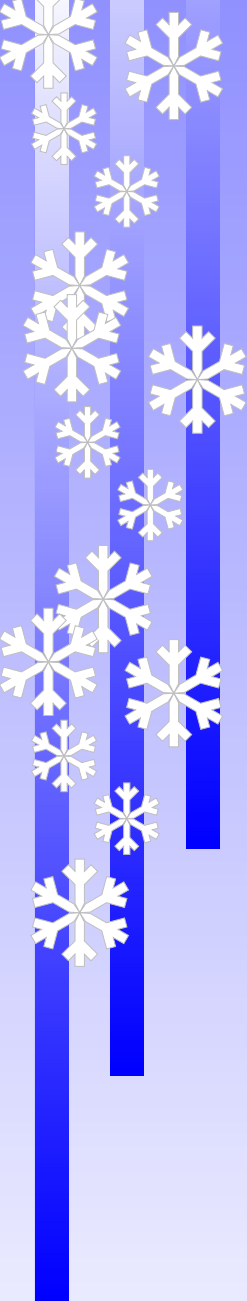
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 $\xrightarrow{wp} \boxed{bbbbccccbbcc}$



EOL eco-colonies – generative power

Previous results:

Vavrečková, Š.: *Eko-kolonie*. In: Kognice a umělý život V. Silesian University, Opava (2005), 601-612. ISBN 80-7248-310-2

- ✓ comparison with colonies with one alphabet (main and terminal alphabet are equal),
- ✓ study of various possible derivation modes.

Vavrečková, Š.: *EOL eko-kolonie*. In: Kognice a umělý život VI. Silesian University, Opava (2006), 413-419. ISBN 80-7248-355-2

- ✓ comparison with eco-grammar systems,
- ✓ comparison with some types of colonies with two alphabets.

EOL eco-colonies – generative power

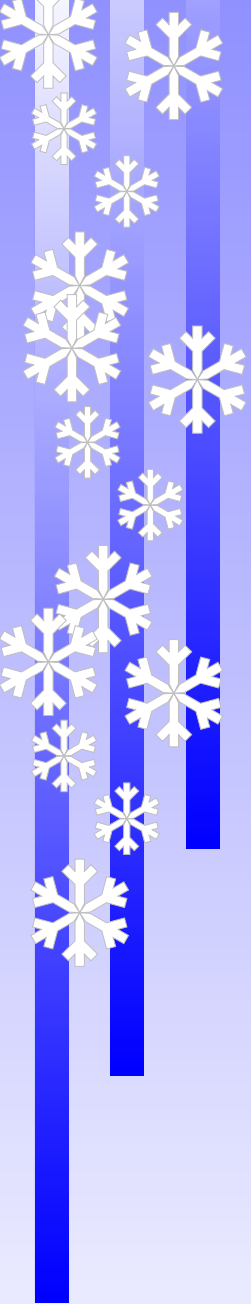
In this paper:

$$COL_{wp} \subset EEC_{wp}$$

⇒ with the same derivation type the addition of the property self-developing in the environment enhances generative power,

$$0EC_{wp} \subset EEC_{wp}$$

⇒ with the same derivation type the addition of the second alphabet enhances generative power.



*Thank you
for your attention.*