

COINC Library: a toolbox for the Network Calculus

[Invited Presentation, Extended Abstract]

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This talk will present the Scilab toolbox for Network Calculus computation. It was developed thanks to the INRIA ARC COINC project (COmputational Issue in Network Calculus see <http://perso.bretagne.ens-cachan.fr/~bouillar/coinc/spip.php?rubrique1>). This software library deals with the computation of ultimate pseudo-periodic functions. They are very useful to compute performance evaluation in network (e.g. Network Calculus) or in embedded system (Real Time Calculus).

Each function f is composed of segments characterized by (x, y, y^+, ρ) (see figure ??), arranged in two lists of segments denoted p and q and with a segment denoted r , it is denoted $f = p \oplus qr^*$. List p is composed of segments which depict a transient behavior, list q is composed of segments which represent a pattern repeated periodically, segment r is a point representing the periodicity of function f (see figure ??). The formulation is inspired by the one of periodical series in the idempotent semiring of formal series such as introduced in [?], and which have its own Scilab toolbox called Minmaxgd [?] based on algorithms proposed in [?] and in [?], [?]. The COINC toolbox yields five operations handling ultimately pseudo periodic function (uppf), namely

- the minimum of two uppf (the sum in the $(\min, +)$ setting):

$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \oplus (p_2 \oplus q_2 r_2^*);$$

- the $(\min, +)$ convolution of two uppf (product of two uppf):

$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \otimes (p_2 \oplus q_2 r_2^*);$$

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- the $(\min, +)$ deconvolution of two uppf (residuation of two uppf):

$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \dot{\phi} (p_2 \oplus q_2 r_2^*);$$

- the addition of two uppf (the Hadamard product of uppf):

$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \odot (p_2 \oplus q_2 r_2^*);$$

- the sub-additive closure (the Kleene-star of an uppf):

$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*)^*.$$

The software is based on algorithms given in [?], and also in [?], [?] and [?], it is available as a Scilab contribution and on the following url <http://www.istia.univ-angers.fr/~lagrange/COINC>.

During the talk some illustrations about Network Calculus (see [?, ?]) will be proposed. Let just recall that an arrival curve is a monomial $(0, \sigma, \rho)$ with σ the burst and ρ the arrival rate, and a service curve is represented by a polynomial with two monomials $m_1 \oplus m_2$ with $m_1 = (0, 0, 0, 0)$ and $m_2 = (\tau, 0, 0, \theta)$ with τ the delay and θ the service rate.

1. ADDITIONAL AUTHORS

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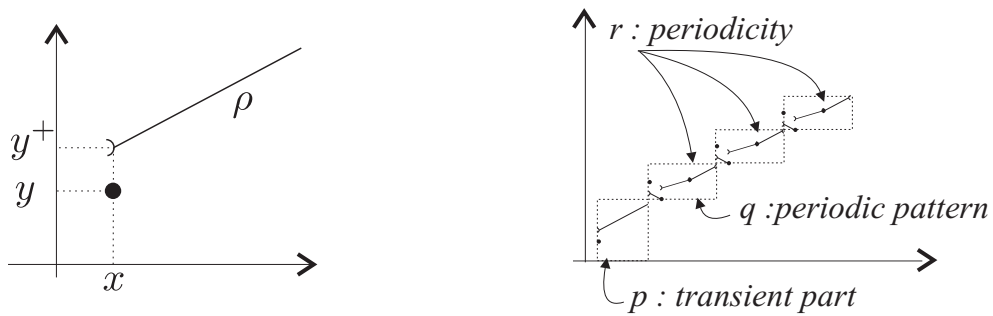


Figure 1: A monomial (a point (x, y) and an half-line starting in (x, y^+) with a slope equal to ρ) and an uppf function ($f = p \oplus qr^*$).

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