COINC Library: a toolbox for the Network Calculus [Invited Presentation, Extended Abstract]

Anne Bouillard
ENS Cachan / IRISA
Campus de Ker Lann
35170 Bruz, France
anne.bouillard@bretagne.ens-cachan.fr

Bertrand Cottenceau
ISTIA / Université d'Angers
62 avenue Notre-Dame du Lac
49000 Angers, France
bertrand.cottenceau@istia.univ-angers.fr

Bruno GaujalINRIA
Rhône-Alpes
52 Av. Jean Kuntzmann
38330 Montbonnot, France
bruno.gaujal@inria.fr

Laurent Hardouin
ISTIA / Université d'Angers
62 avenue Notre-Dame du Lac
49000 Angers, France
laurent.hardouin@istia.univ-angers.fr

Sébastien Lagrange
ISTIA / Université d'Angers
62 avenue Notre-Dame du Lac
49000 Angers, France
sebastien.lagrange@istia.univ-angers.fr

Mehdi Lhommeau
ISTIA / Université d'Angers
62 avenue Notre-Dame du Lac
49000 Angers, France
mehdi.lhommeau@istia.univ-angers.fr

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 is composed of segments characterized by (x, y, y^+, ρ) (see figure **??**), arranged in two lists of sergments 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 is 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 minmium 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):
$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \otimes (p_2 \oplus q_2 r_2^*);$$
- the (min,+) deconvolution of two uppf (residuation of two uppf):
$$p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \not\phi (p_2 \oplus q_2 r_2^*);$$
- 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 $(0, \sigma, \sigma, \rho)$ with σ the burst and ρ the arrival rate, and a service curve is represented by 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.

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1. ADDITIONAL AUTHORS

Éric Thierry (ENS Lyon / LIP / IXXI, 46, allée d'Italie, 69007 Lyon, France email: `eric.thierry@ens-lyon.fr`).

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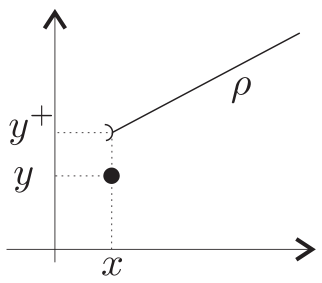

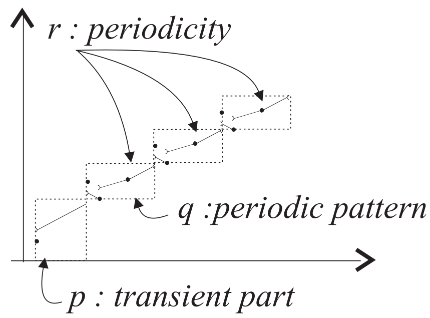

Figure 1: A monomial (a point (x, y) and an half-line starting in (x, y^+) with a slope equal to ρ) and an uppf function ($f = p \oplus qr^*$).

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