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 $(x, y, y^+, \rho, x_n)$ (see figure 1), 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 1). The formulation is inspired by the one of periodical series in the idempotent semiring of formal series such as introduced in [1], and which have is own Scilab toolbox called Minmaxgd [5] based on algorithms proposed in [6] and in [4], [7]. The COINC toolbox yields six 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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Figure 1 – A monomial (a point \((x, y)\) and a segment starting in \((x, y^+)\) with a slope equal to \(\rho\) and ending in \(x_n\)) and an uppf function \((f = p \oplus qr^*)\).

- The \((\min,+)\) deconvolution of two uppf (residuation of two uppf):
  \[ p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \odot (p_2 \oplus q_2 r_2^*) \]

- The addition of two uppf (The Hadamard product of two uppf):
  \[ p \oplus qr^* = (p_1 \oplus q_1 r_1^*) \odot (p_2 \oplus q_2 r_2^*) \]

- The subadditive cloute (The Kleene star of an uppf):
  \[ p \oplus qr^* = ((p_1 \oplus q_1 r_1^*))^* \]

The software is based on algorithms given in [2], and also in [6], [4] and [7], it is available as a Scilab contribution and on the following url \url{http: \www.istia.univ-angers.fr\~lagrange\COINC}.

During the talk some illustrations about Network Calculus (see [8],[3]) will be proposed including all those operations. Let just recall that an arrival curve is a segment \((0, \sigma, \sigma, \rho, +\infty)\) with \(\sigma\) the burst and \(\rho\) the arrival rate, and a service curve is represented by a list of two segments \(m_1 \oplus m_2\) with \(m_1 = (0, 0, 0, 0, \tau)\) and \(m_2 = (\tau, 0, 0, \theta, +\infty)\) with \(\tau\) the delay and \(\theta\) the service rate.

Références


