1 On Steady State Controller in Min-Plus Algebra

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Synchronization phenomena occurring in systems where dynamic behavior is represented by a flow of fluid are well modeled by continuous $(min, +)$-linear systems. A feedback controller design method is proposed for such systems in order that the system output asymptotically behaves like polynomial input. Such a controller objective is well-known in the conventional linear systems theory. Indeed, the steady-state accuracy of conventional linear systems is classified according to their final responses to polynomial inputs such as steps, ramps, and parabolas. The ability of the system to asymptotically track polynomial inputs is given by the highest degree, k, of the polynomial for which the error between system output and reference input is finite but nonzero. We call the system *type* k to identify this polynomial degree. For example, a *type* 1 system has finite, nonzero error to a first-degree polynomial input (ramp).
An analogous definition of system *type* k is given for continuous $(min, +)$-linear systems and leads to simple conditions as in conventional system theory. In addition to the conditions that the resulting controller must satisfy, we look for the *greatest* controller to satisfy the *just in time* criterion. For a manufacturing system, such an objective allows the releasing of raw parts at the latest dates such that the customer demand is satisfied.