

Modely konkurentných systémov

Formálne metódy tvorby softvéru

Damas Gruska

Katedra aplikovanej informatiky, I20, gruska@fmph.uniba.sk

$$\begin{array}{lll}
\text{ACT} \frac{}{\alpha.P \xrightarrow{\alpha} P} & \text{SUM1} \frac{P \xrightarrow{\alpha} P'}{P + Q \xrightarrow{\alpha} P'} & \text{SUM2} \frac{Q \xrightarrow{\alpha} Q'}{P + Q \xrightarrow{\alpha} Q'} \\
\text{COM1} \frac{P \xrightarrow{\alpha} P'}{P \mid Q \xrightarrow{\alpha} P' \mid Q} & \text{COM2} \frac{Q \xrightarrow{\alpha} Q'}{P \mid Q \xrightarrow{\alpha} P \mid Q'} & \text{COM3} \frac{P \xrightarrow{\alpha} P' \quad Q \xrightarrow{\bar{\alpha}} Q'}{P \mid Q \xrightarrow{\tau} P' \mid Q'} \\
\text{CON} \frac{P \xrightarrow{\alpha} P'}{K \xrightarrow{\alpha} P'} \quad K \stackrel{\text{def}}{=} P & \text{REL} \frac{P \xrightarrow{\alpha} P'}{P[f] \xrightarrow{f(\alpha)} P'[f]} & \text{RES} \frac{P \xrightarrow{\alpha} P'}{P \setminus L \xrightarrow{\alpha} P' \setminus L} \quad \alpha, \bar{\alpha} \notin L
\end{array}$$

$Act = A \cup \{\tau\}$, $Actt = Act \cup \{t\}$

$a, b, \dots$ prvky z A , $u, v, \dots$ prvky z Act , $x, y \dots$ prvky z $Actt$

$$\frac{}{x.P \xrightarrow{x} P}$$

A1

$$\frac{}{u.P \xrightarrow{t} u.P}$$

A2

$$\frac{}{Nil \xrightarrow{t} Nil}$$

A3

$$\frac{P \xrightarrow{u} P'}{P \mid Q \xrightarrow{u} P' \mid Q}$$

Pa1

$$\frac{P \xrightarrow{u} P'}{Q \mid P \xrightarrow{u} Q \mid P'}$$

Pa2

$$\frac{P \xrightarrow{a} P', Q \xrightarrow{\bar{a}} Q'}{P \mid Q \xrightarrow{\tau} P' \mid Q'}$$

Pa3

$$\frac{P \xrightarrow{t} P', Q \xrightarrow{t} Q', P \mid Q \not\xrightarrow{\tau}}{P \mid Q \xrightarrow{t} P' \mid Q'}$$

Pa4

$$\frac{P \xrightarrow{u} P'}{P + Q \xrightarrow{u} P'}$$

S1

$$\frac{P \xrightarrow{u} P'}{Q + P \xrightarrow{u} P'}$$

S2

$$\frac{P \xrightarrow{t} P', Q \xrightarrow{t} Q'}{P + Q \xrightarrow{t} P' + Q'}$$

S3

SOS rules for unit delays in TCCS (d ranges over nonnegative integers)

$$\begin{array}{l}
 \text{ONE} \frac{}{d.P \xrightarrow{1} (d-1).P} \quad d \geq 1 \quad \text{ACT} \frac{}{\alpha.P \xrightarrow{1} \alpha.P} \quad \alpha \neq \tau \quad \text{REL} \frac{P \xrightarrow{1} P'}{P[f] \xrightarrow{1} P'[f]} \\
 \text{SUM} \frac{P \xrightarrow{1} P' \quad Q \xrightarrow{1} Q'}{P + Q \xrightarrow{1} P' + Q'} \quad \text{CON} \frac{P \xrightarrow{1} P'}{K \xrightarrow{1} P'} \quad K \stackrel{\text{def}}{=} P \quad \text{RES} \frac{P \xrightarrow{1} P'}{P \setminus L \xrightarrow{1} P' \setminus L} \\
 \text{COM} \frac{P \xrightarrow{1} P' \quad Q \xrightarrow{1} Q'}{P \mid Q \xrightarrow{1} P' \mid Q'} \quad \text{if } P \mid Q \not\rightarrow
 \end{array}$$