Formulário

Sintaxe

$$E \ ::= \ A(v_1, ..., v_n) \ \mid \ \mathbf{0} \ \mid \ a.E \ \mid \ E_0 + E_1 \ \mid \ E_0 \mid E_1 \ \mid \ \mathsf{new}\, K\ E$$

Congruência estrutural

- $\equiv$ é uma relação de *equivalência* fechada para conversão-α e preservada pelos operadores
- *composição paralela* e *escolha* formam, com $\mathbf{0}$, monoides abelianos
- (para $a \notin \mathsf{free}(P)$) $\mathsf{new}\,\{a\}\ (P \mid Q) \equiv P \mid \mathsf{new}\,\{a\}\ Q$ e $\mathsf{new}\,\{a\}\ \mathbf{0} \equiv \mathbf{0}$
- (para $A(\tilde{x}) \triangleq P_A$) $A\langle\tilde{y}\rangle \ \equiv \ \{\tilde{y}/\tilde{x}\}\, P_A$

Semântica

$$\frac{}{\alpha.E \xrightarrow{\alpha} E}\,(prefix) \qquad \frac{E \xrightarrow{\alpha} E' \quad F \xrightarrow{\overline{\alpha}} F'}{E \mid F \xrightarrow{\tau} E' \mid F'}\,(react)$$

$$\frac{E \xrightarrow{\alpha} E'}{E \mid F \xrightarrow{\alpha} E' \mid F}\,(par-l) \qquad \frac{F \xrightarrow{\alpha} F'}{E \mid F \xrightarrow{\alpha} E \mid F'}\,(par-r)$$

$$\frac{E \xrightarrow{\alpha} E'}{E + F \xrightarrow{\alpha} E'}\,(sum-l) \qquad \frac{F \xrightarrow{\alpha} F'}{E + F \xrightarrow{\alpha} F'}\,(sum-r)$$

$$\frac{E \xrightarrow{\alpha} E'}{\mathsf{new}\,\{\beta\}\ E \xrightarrow{\alpha} \mathsf{new}\,\{\beta\}\ E'}\,(res) \quad (\text{se } \alpha \notin \{\beta, \overline{\beta}\})$$

$$\frac{\{\tilde{\beta}/\tilde{\delta}\}\, E_A \xrightarrow{\alpha} E'}{A(\tilde{\beta}) \xrightarrow{\alpha} E'}\,(ident) \quad (\text{se } A(\tilde{\delta}) \triangleq E_A)$$

Teoria equivalência estrita

$$
\begin{aligned}
(E + F) + G &\sim E + (F + G) \\
E + F &\sim F + E \\
E + \mathbf{0} &\sim E \\
E + E &\sim E \\
(E \mid F) \mid G &\sim E \mid (F \mid G) \\
E \mid F &\sim F \mid E \\
E \mid \mathbf{0} &\sim E
\end{aligned}
$$

$$
\begin{aligned}
\mathsf{new}\,K\ E &\sim E & &\text{se } \mathbb{L}(E) \cap (K \cup \overline{K}) = \emptyset \\
\mathsf{new}\,K'\ (\mathsf{new}\,K\ E) &\sim \mathsf{new}\,K \cup K'\ E & & \\
\mathsf{new}\,K\ (E \mid F) &\sim \mathsf{new}\,K\ E \mid \mathsf{new}\,K\ F & &\text{se } \mathbb{L}(E) \cap \overline{\mathbb{L}(F)} \cap (K \cup \overline{K}) = \emptyset
\end{aligned}
$$

$$
\begin{aligned}
E \sim\ & \sum \{a.\mathsf{new}\,K\ (E_1 \mid ... \mid E_i' \mid ... \mid E_n) |\ E_i \xrightarrow{a} E_i' \ \wedge\ a \notin K \cup \overline{K}\} \\
& + \\
& \sum \{\tau.\mathsf{new}\,K\ (E_1 \mid ... \mid E_i' \mid ... \mid E_j' \mid ... \mid E_n) |\ E_i \xrightarrow{a} E_i' \ \wedge\ E_j \xrightarrow{\overline{a}} E_j'\}
\end{aligned}
$$

(para $E \triangleq \mathsf{new}\,K\ (E_1 \mid ... \mid E_n)$, com $n \geq 0$)

$$
\begin{aligned}
\mathsf{new}\,K\ (E + F) &\sim \mathsf{new}\,K\ E + \mathsf{new}\,K\ F \\
\mathsf{new}\,K\ (a.E) &\sim \begin{cases} \mathbf{0} & \text{se } a \in (K \cup \overline{K}) \\ a.(\mathsf{new}\,K\ E) & \text{caso contrário} \end{cases}
\end{aligned}
$$

Equivalência Observacional

$$
\frac{}{E \stackrel{\epsilon}{\Longrightarrow} E}\ (O_1)
$$

$$
\frac{E \xrightarrow{\tau} E' \quad E' \stackrel{\epsilon}{\Longrightarrow} F}{E \stackrel{\epsilon}{\Longrightarrow} F}\ (O_2)
$$

$$
\frac{E \stackrel{\epsilon}{\Longrightarrow} E' \quad E' \xrightarrow{a} F' \quad F' \stackrel{\epsilon}{\Longrightarrow} F}{E \stackrel{a}{\Longrightarrow} F}\ (O_3) \quad \text{para } a \in L
$$

- $\approx$ é uma congruência, excepto para contextos aditivos arbitrários
- $E \ \approx\ \tau.E$

Igualdade

- $a.\tau.E = a.E$, $E + \tau.E = \tau.E$, $a.(E + \tau.F) = a.(E + \tau.F) + a.F$
- $E = F$ sse, para todo o $G \in \mathbb{P}$, $E + G \ \approx\ F + G$
- $E \approx F$ sse $E = F$ ou $E = \tau.F$ ou $\tau.E = F$
- $\sim\ \subseteq = \subseteq\ \approx$