

- DSLL grammar:

$X \in \text{TypeVars}$	(type variables)
$x \in \text{Vars}$	(variables)
$y ::= X \mid x$	(variables)
$T ::= C(\bar{A}) \mid X \mid \text{Top}$	(types)
$A ::= x \mid T$	(type arguments)
$ST ::= \epsilon \mid <: C$	(sub types)
$k ::= \text{type} \mid T$	(kinds)
$cd ::= \text{tconstructor } C (\bar{y} : \bar{k}) : \text{type } ST$	(type cons decl stmt)
$vd ::= \text{vconstructor } c [\bar{y} : \bar{k}] (\bar{x} : \bar{T}) : T$	(value cons decl stmt)
$od ::= \text{operator } f [\bar{y} : \bar{k}] (\bar{x} : \bar{T}) : T$	(operator decl stmt)
$pd ::= \text{predicate } p [\bar{y} : \bar{k}] (\bar{x} : \bar{T}) : \text{Prop}$ $\quad \mid \text{predicate } p (\bar{x} : \overline{\text{Prop}}) : \text{Prop}$	(predicate decl stmts)
$\mathbf{P} ::= \overline{cd} \overline{vd} \overline{od} \overline{pd}$	(program)

- Substance grammar:

$X \in \text{TypeVars}$	(type variables)
$x \in \text{Vars}$	(variables)
$E ::= x \mid f(\bar{E}) \mid c(\bar{E})$	(expressions)
$D ::= x :: \text{Property}$	(deconstructors)
$L ::= \text{NoLabel } \bar{x} \mid \text{AutoLabel } \bar{x} \mid \text{Label } x \$\text{str}\$$	(labels)
$Q ::= p(\bar{E}) \mid p(\bar{Q})$	(predicates)
$S ::= T x \mid x := E \mid E = E \mid Q \mid Q = Q \mid x := D$ $\quad \mid L$	(statements)
$\mathbf{P} ::= \bar{S}$	(program)

Fig. 24. Substance language grammar

- Style language grammar:

$y \in \text{StyVars}$	(STYLE variables)
$H ::= y \mid \mathcal{S}$	(a header is a namespace or a selector)
$\mathcal{B} ::= (H, \mathbb{B})$	(a pair of a header and a block)
$\mathbb{P} ::= \overline{\mathcal{B}}$	(a STYLE program)

- Style selector grammar:

$X \in \text{TypeVars}$	(type variables)
$x \in \text{SubVars}$	(SUBSTANCE variables)
$y \in \text{StyVars}$	(STYLE variables)
$B ::= x \mid y$	(binding forms)
$T ::= C(\overline{A}) \mid X$	(types)
$A ::= B \mid T$	(type constructor arguments)
$E ::= B \mid f(\overline{E}) \mid c(\overline{E})$	(expressions)
$Q ::= p(\overline{E}) \mid p(\overline{Q})$	(predicates)
$\mathbb{S}_o ::= T B$	(SUBSTANCE object declarations)
$\mathbb{S}_r ::= B := E \mid Q$	(statements relating SUBSTANCE objects)
$\mathcal{S} ::= (\overline{\mathbb{S}_o})_1 \text{ with } (\overline{\mathbb{S}_o})_2 \text{ where } \overline{\mathbb{S}_r}$	(selectors)

- Style block grammar:

$n \in \text{StyFields}$	(STYLE block fields and shape properties)
$\mathbb{C} \in \text{StyLibrary}$	(Constructors for graphical primitives)
$\chi \in \text{StyLibrary}$	(Function names)
$i \in \mathbb{N}$	(Natural numbers)
$L ::= \text{BoolLit} \mid \text{StringLit} \mid \text{IntLit} \mid \text{FloatLit} \mid \dots$	(literals)
$\epsilon_c ::= -\epsilon \mid \epsilon + \epsilon \mid \epsilon * \epsilon \mid \dots$	(inline computations)
$\pi ::= B.n \mid \pi.n$	(paths)
$\epsilon ::= L \mid \pi \mid \chi(\overline{\epsilon}) \mid \epsilon_c \mid \overline{\epsilon} \mid \pi[i] \mid \mathbb{C} \overline{n = \epsilon}$	(expressions)
$\psi ::= \pi = \epsilon \mid \text{delete } \pi$	(statements)
$\mathbb{B} ::= \overline{\psi}$	(blocks)