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**Rule 0.27** *⟨Use Efficient Loop Increment⟩*

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<pre>[...] <b>contract</b> A {   [...]   <b>function</b> f(pds) {     [...]     <b>for</b>(init; cond; i += 1) {       stmts     }     stmts'   }   [...] }</pre>	=	<pre>[...] <b>contract</b> A' {   [...]   <b>function</b> f(pds) {     [...]     <b>for</b>(init; cond; ++i) {       stmts     }     stmts'   }   [...] }</pre>
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**where**

- $i$  is the loop counter variable;
- $i += 1$  is the addition assignment increment operation;
- $++i$  is the pre-increment operator;
- $init$  and  $cond$  are the loop initialization and condition expressions;
- $stmts$  represents the loop body statements;
- $pds$  are the parameter declarations of function  $f$ ;
- $stmts'$  represents statements following the loop.

**provided**

- The loop uses  $i += 1$  for incrementing the counter;
- The pre-increment operator  $++i$  produces equivalent behavior;
- The increment operation occurs only in the loop update expression;
- No side effects depend on the specific increment method used;
- The pre-increment generates more efficient bytecode than addition assignment.

**Invariant:**

- Let  $s_i$  and  $s'_i$  be the initial state of  $A$  and  $A'$ , respectively.
- Let  $s_f$  and  $s'_f$  be the state reached by  $A$  and  $A'$ , respectively, after  $A.f()$  and  $A'.f()$  are executed from  $s_i$  and  $s'_i$ , respectively.
- Then, the coupling invariant is

$$\forall s_i, s'_i. (s_i = s'_i) \rightarrow (s_f = s'_f)$$

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