Input/Output Relations, Domains, State Invariants and Abstraction Relations in an MIS and an MID

Extra Notes

SFWR ENG 2B03

2003

Robert L. Baber

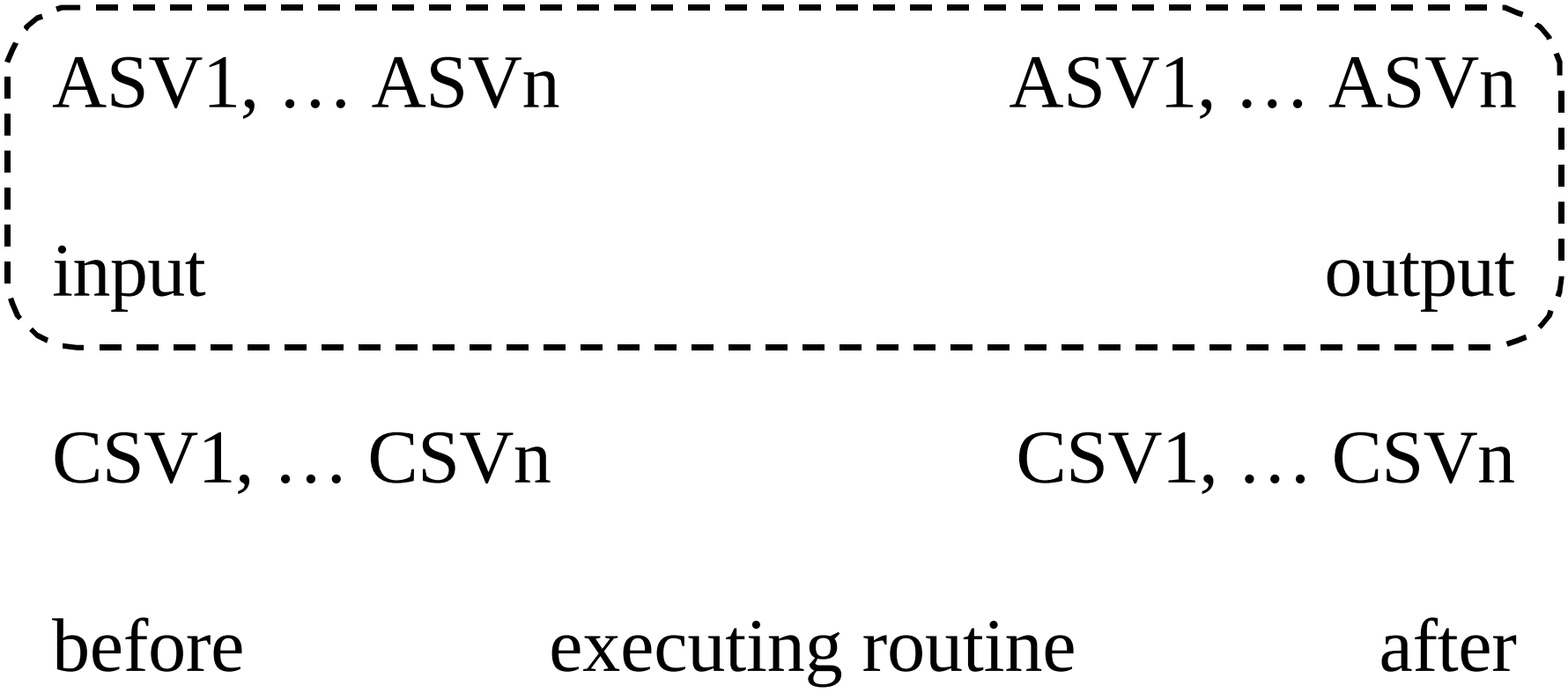
The Variables in MIS and MID

Values of abstract and concrete state variables, input and output variables, before and after

ASV1, … ASVn		ASV1, … ASVn
input		output
CSV1, … CSVn		CSV1, … CSVn
before	executing routine	after

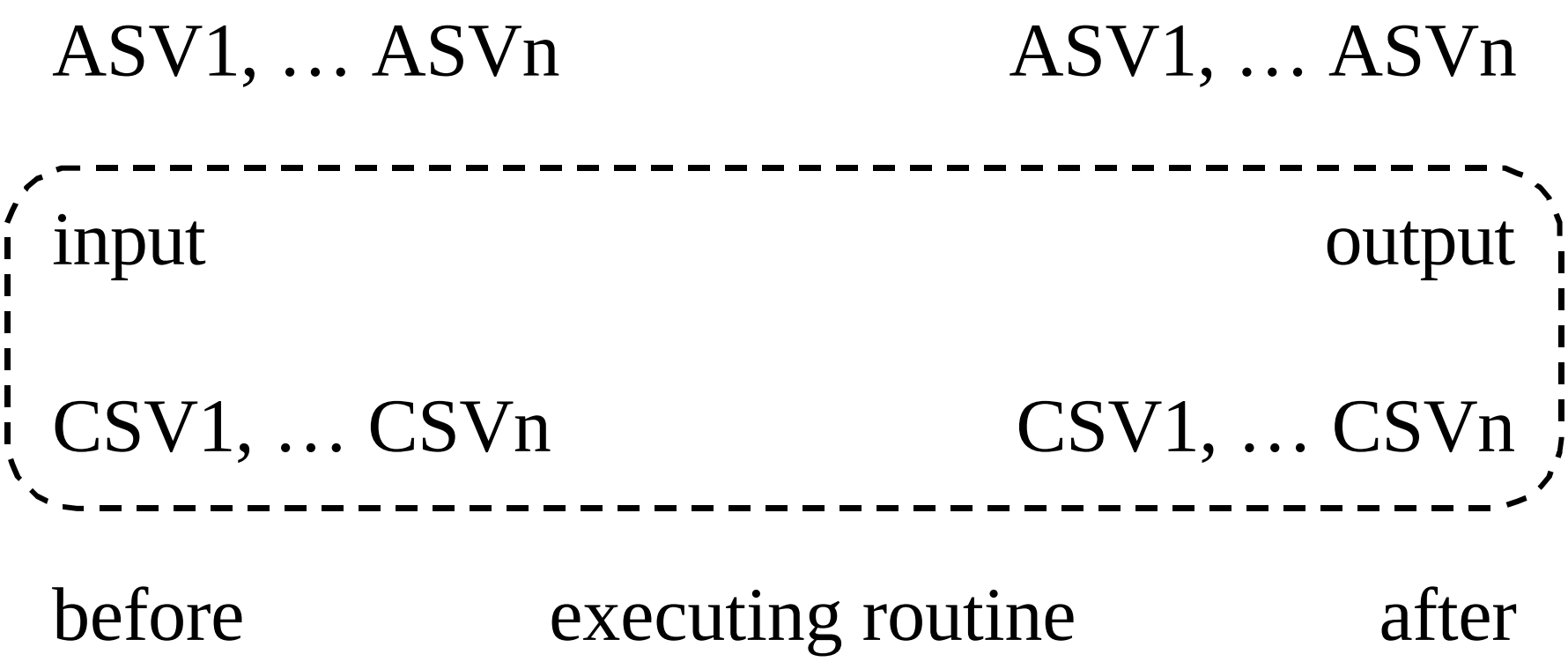
Input/output relation in MIS

Values of abstract state variables and
input and output variables, before and after



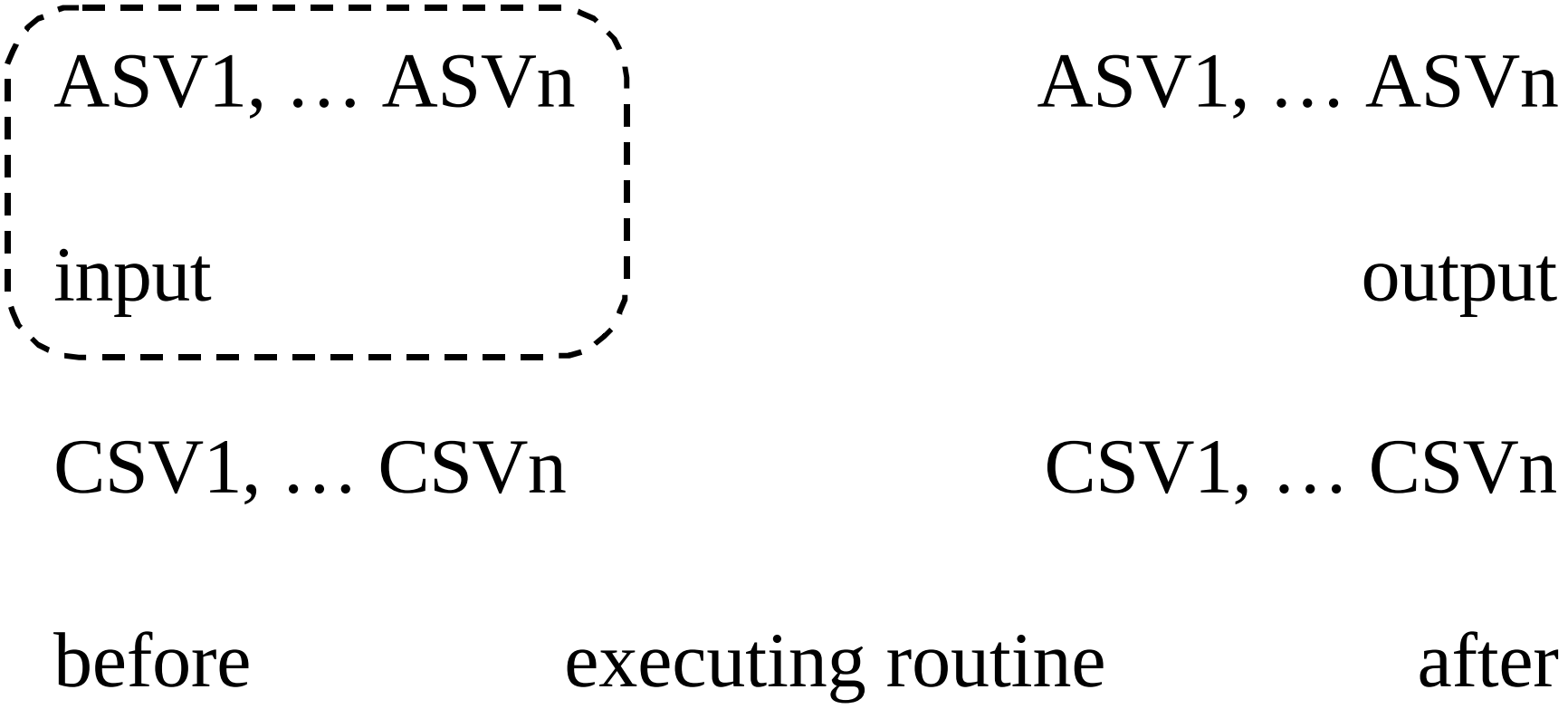
Input/output relation in MID

Values of concrete state variables and
input and output variables, before and after



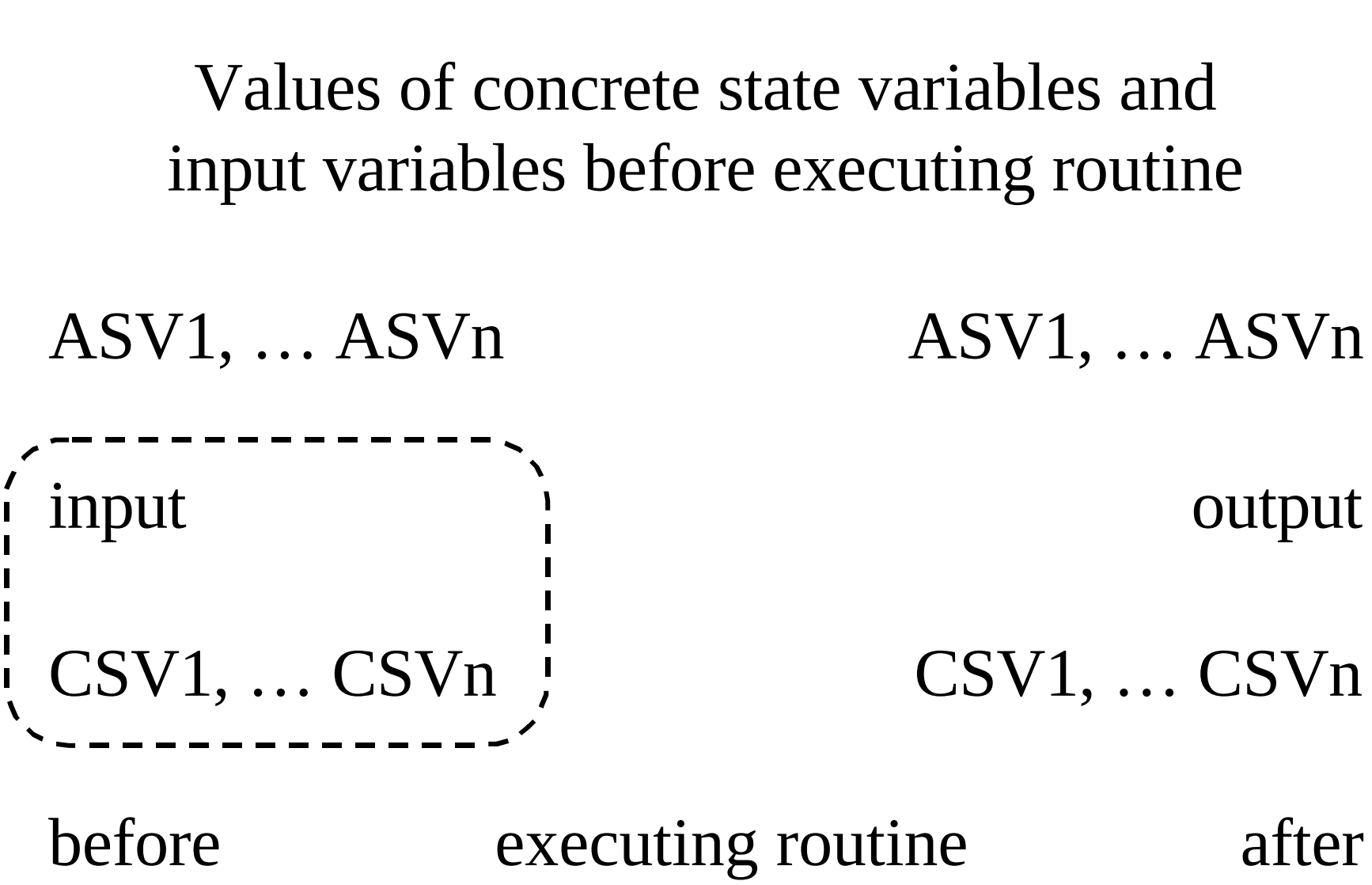
Domain in MIS

Values of abstract state variables and
input variables before executing routine



Domain in MID

Values of concrete state variables and input variables before executing routine



State Invariant in MIS

Values of abstract state variables *only*
State invariant true before — and also after

ASV1, … ASVn

ASV1, … ASVn

CSV1, … CSVn

CSV1, … CSVn

before executing routine after

State Invariant in MID

Values of concrete state variables *only*
State invariant true before — and also after

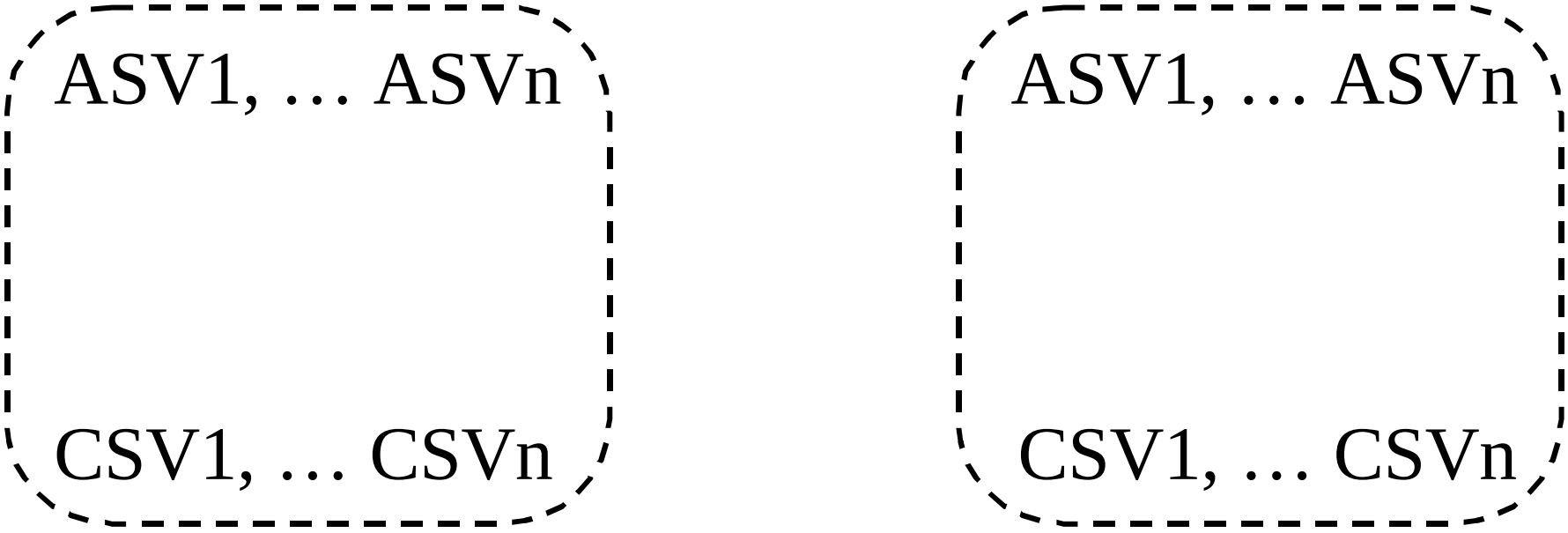
ASV1, … ASVn ASV1, … ASVn

CSV1, … CSVn CSV1, … CSVn

before executing routine after

Abstraction Relation (in MID only)

Values of abstract and concrete state variables
Abstraction relation true before — and also after



before executing routine after

MIS vs. MID

- MIS: abstract state variables, external view
- MID: concrete state variables, internal view

Input/Output Relation and Domain

- Input/output relation: values of state variables before and after, input and output variables
- Domain: values of state variables before and input variables
- Input/output relation: relates values of variables before and after
- Domain: refers only to values of variables before

State Invariant and Abstraction Relation

- State invariant: values of state variables only, at one point in time (either before or after)
- Abstraction relation: values of both abstract and concrete state variables, at one point in time (either before or after)
- Neither the state invariant nor the abstraction relation relates any values before execution with values after execution.

Essence of MIS

- external view
- abstract state space (external view of state space)
- relates the values of variables before and after execution of each routine, i.e. the service to be performed
- specifies the interface, i.e. communication between the calling and the called routines

Essence of MID

- internal view
- concrete state space (state space to be actually implemented)
- specifies the relation between the abstract state space and the concrete state space
- relates the values of variables before and after execution of each routine, i.e. the service to be performed
- specifies the interface

Essence of the Input/Output Relation

- relates the values of variables before and after execution of the routine
- depends on the input and output parameters and the values of variables before and after execution of the routine

Essence of the Domain

- specifies the relation between the values of variables that must be (is assumed to be) true when the routine is called
- depends on the input and the initial values of variables only, not on the output or values of variables after execution of the routine
- “exception”: an action to be performed if the above relation is false may be specified

Essence of the State Invariant

- relation between the values of state variables that is true before execution of each routine
- relation also true after execution of routine
- except: state invariant not necessarily true before executing the initialization routine
- purpose of the initialization routine: establish the initial truth of the state invariant

Essence of the Abstraction Relation

- relates the abstract state space and the concrete state space
- specifies (defines) how the concrete state variables represent the abstract state variables
- abstraction relation true before execution of each routine. also true after
- abstraction relation is normally a function from the concrete state space to the abstract state space

Summary

- MIS: external view, MID: internal view
- Input/output relation: relates values of variables at different times
- Domain: specifies conditions for which the routine must execute and deliver results
- State invariant: relates values of state variables at one time
- Abstraction relation: defines how concrete state variables represent abstract state variables