

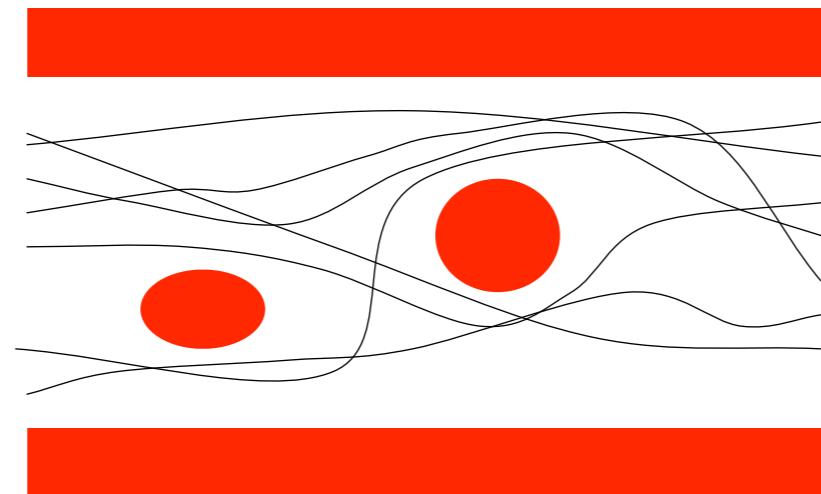
Synchronous dataflow languages easily describe embedded control systems by manipulating discrete time sequences obtained by sampling continuous time functions
 Frequency analysis is a well known method dealing with continuous and discrete time functions

GOAL: Combine these two methods to verify proprieties on embedded system specifications

ABSTRACT INTERPRETATION

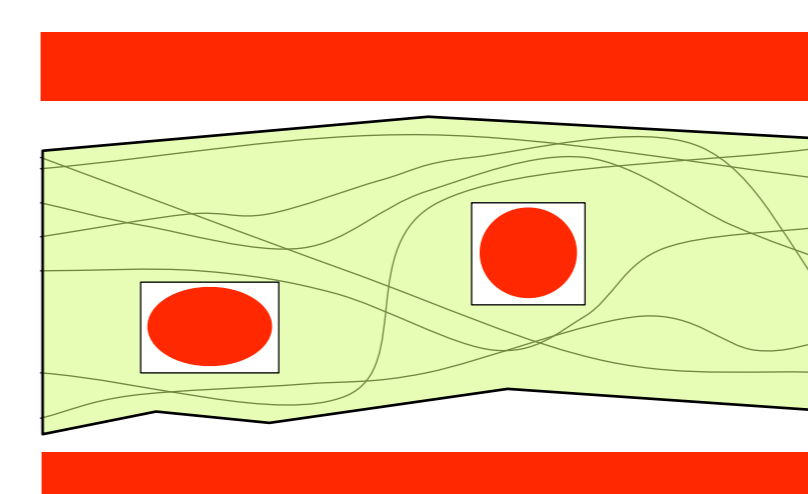
Concrete world

- Semantics: Mathematical model describes all possible executions paths
NOT COMPUTABLE
- Verifying property: Intersection between forbidden zones and execution paths is empty
UNDECIDABLE (Rice theorem)



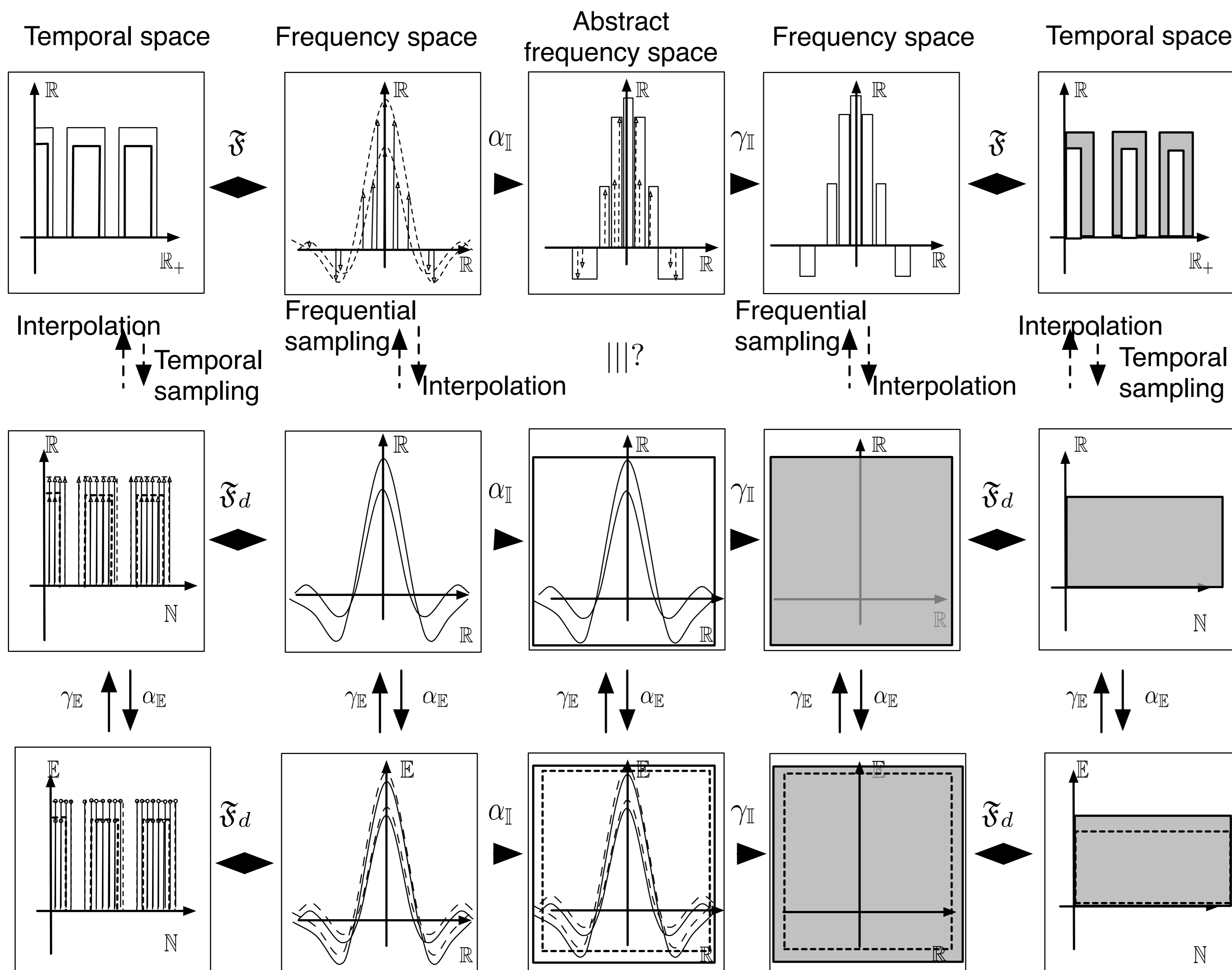
Abstract world

- Semantics: Abstract all possible execution paths with sets of paths without forgetting concrete paths
- Verifying property: Intersection between forbidden zones and abstract execution paths is empty, but **FALSE ALARMS** may be raised with coarse abstraction



ABSTRACT FREQUENCY ANALYSIS

Sensor activity and signal transformations



Mathematical ideal model

- Continuous periodic time functions
- Discrete frequency functions: IDEAL SPECTRA

Sampling time operation

- Discrete time functions with real range
- Periodic frequency functions: COMPUTED SPECTRA

Quantization operation

- Introduce rounding errors in signal values
- Add noise to frequency spectra

- Sampling operation does not modify frequency spectrum, only makes it periodical
- Frequency spectrum is a link between continuous and sampling signals
- Fourier transforms have good proprieties, e.g. linearity, product/convolution conversion

References

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