

Introduction

This poster presents a methodology to perform both mixed-signal analogue-digital and radio frequency and baseband signal processing at the same time. To this end, the analogue circuit simulator LinzFrame has been coupled with MATLAB. The analogue circuitry both at radio frequency (RF), intermediate frequency (IF) and baseband is simulated by LinzFrame, whereas the digital baseband signal processing etc. by MATLAB, employing the full functionality of its toolboxes. Therefore this simulator coupling enables a mixed-mode analogue-digital simulation of radio frequency front-ends and the digital signal processing at the same time. Applications include nonlinear distortion analysis, digital pre-distortion techniques, coexistence analysis of mobile communication standards etc.

LinzFrame Structure

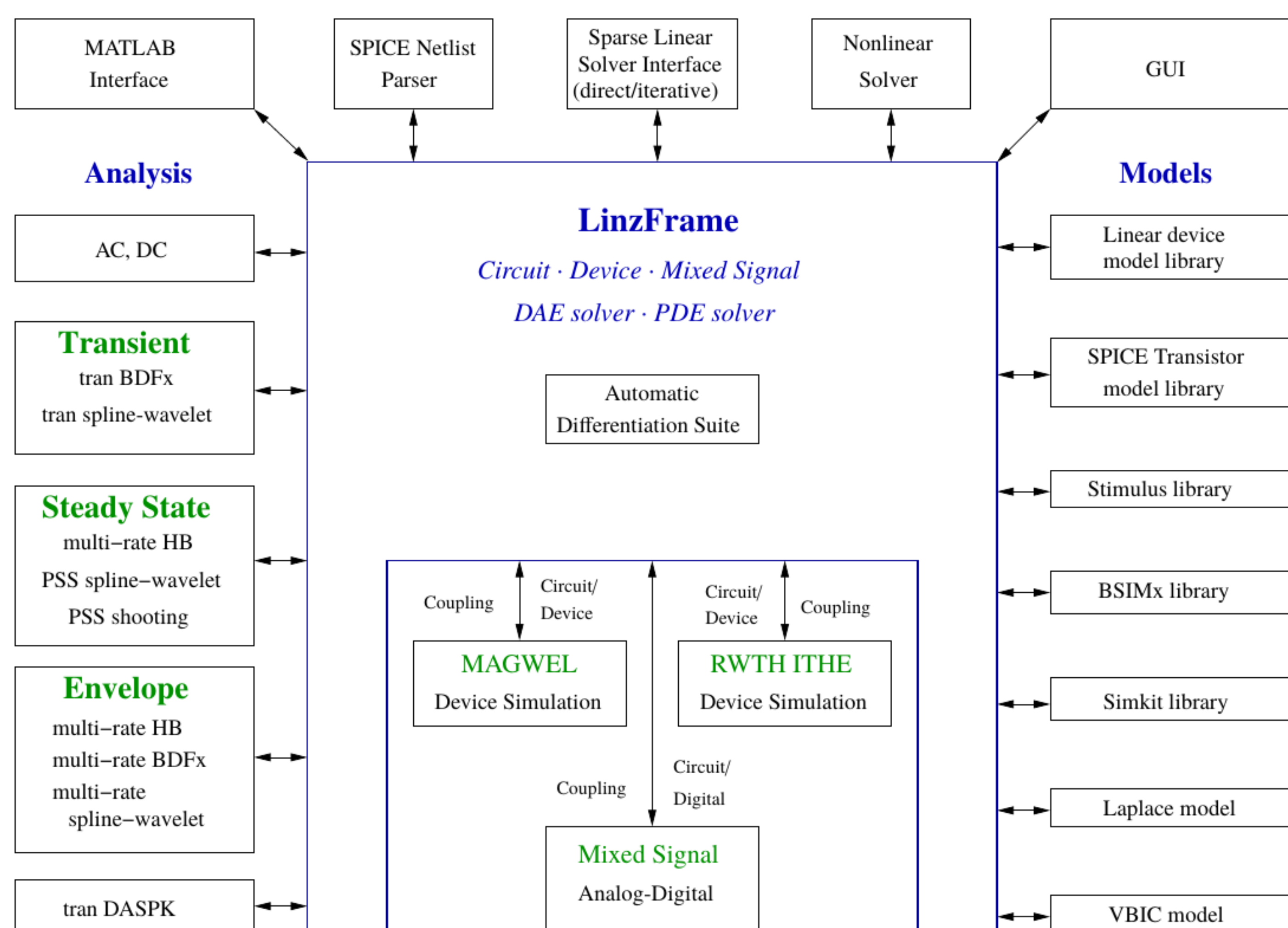


Figure 2: LinzFrame Simulator Structure

Proposed Workflow

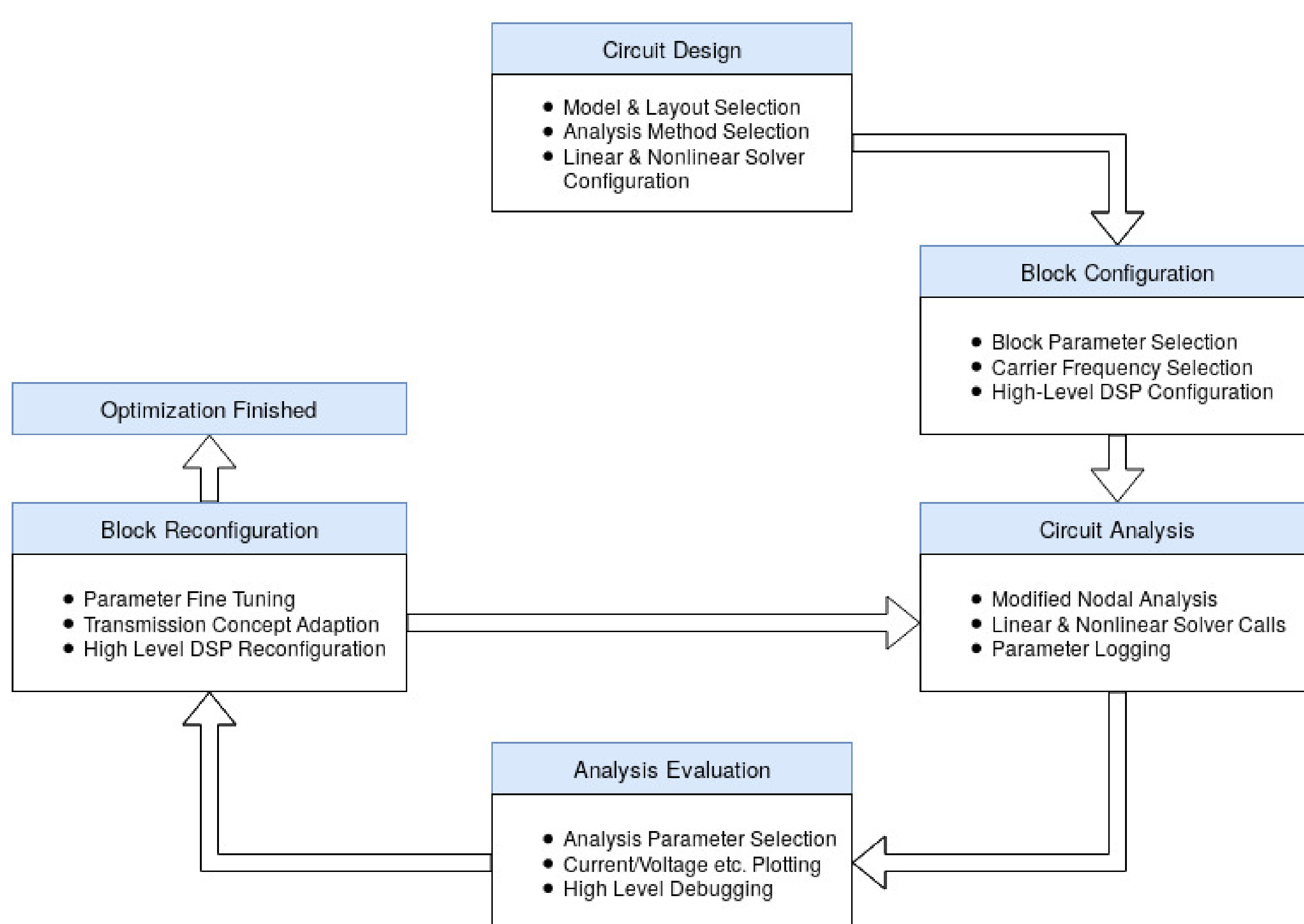


Figure 3: Coupled Simulation and Optimization Workflow

Overall Coupling Structure

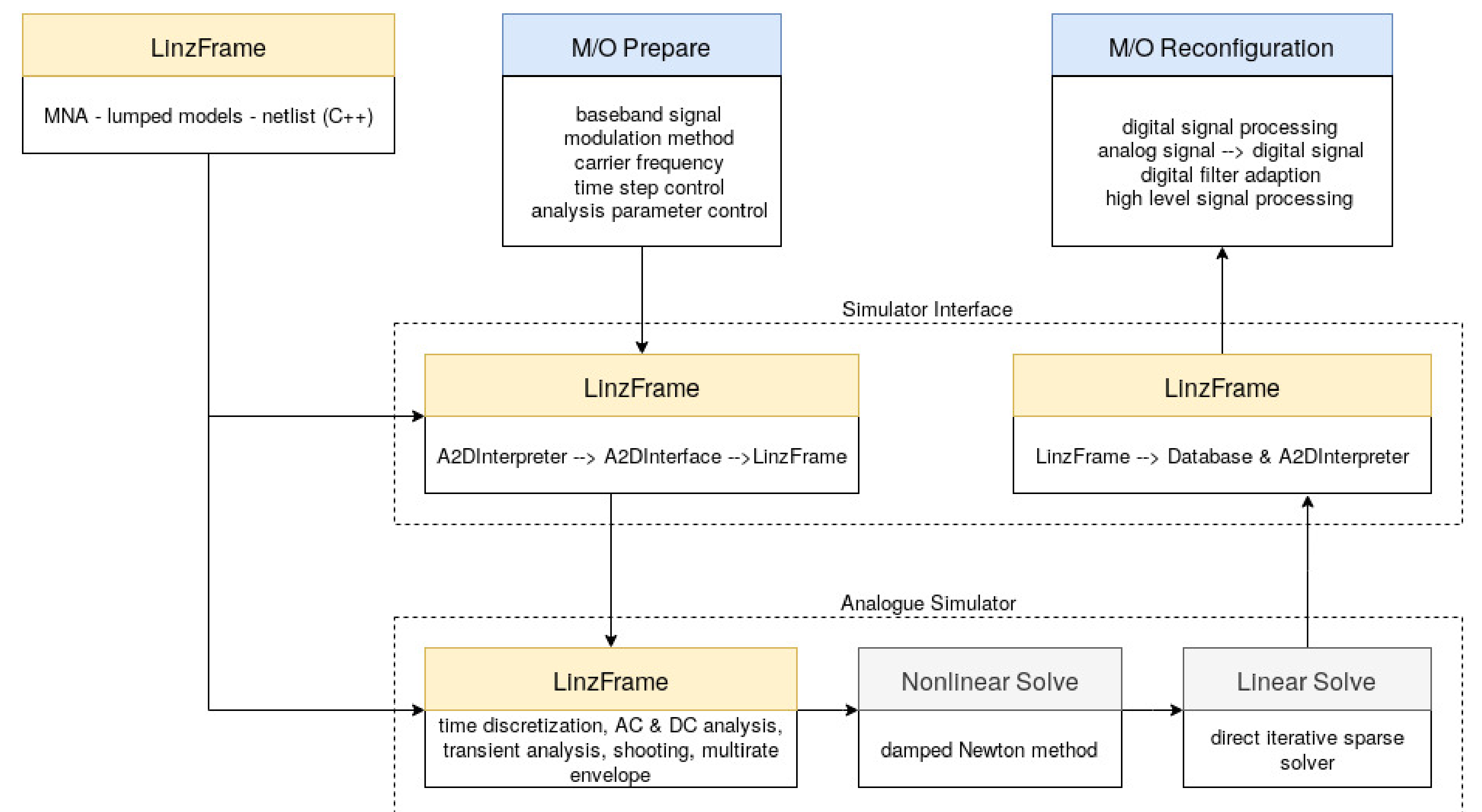


Figure 4: Simulator Coupling - Communication Structure

Application Example

```
clear all; close all; clc;
freq = 1000;
symboltime = 2.0/freq;

% the name of the function call may be changed in the Makefile
bpsk('help');

% set solver parameters
bpsk('setpar', 'out_level', 2);
% ...

% 'set' is used for the ADS compatible signal source 'snd'
% => the BPSK signal amplitude is 1.0 (V)
bpsk('set', 'snd', 'Amplitude', 1.0);
bpsk('set', 'snd', 'fc', freq);

% launch the LinzFrame analogue solver, analyze the circuit for a specific time
bpsk('start', 5*symboltime);

% read the data from the output file, that has been generated by LinzFrame
cd data;
addpath(pwd);
a = dlmread('sol.dat');
cd ..

% change the BPSK signal amplitude of the signal source called 'snd'
% => the BPSK signal amplitude is 2.0 (V)
bpsk('set', 'snd', 'Amplitude', 2.0);

% continue the analogue simulation, the start time is now 5*SymbolTime
bpsk('start', 5*symboltime);

% read the data from the output file, that has been generated by LinzFrame
% be aware that the output file will be cleaned before every simulator launch
cd data;
addpath(pwd);
b = dlmread('sol.dat');
cd ..

% restart the simulation after the script has finished
bpsk('done');
```

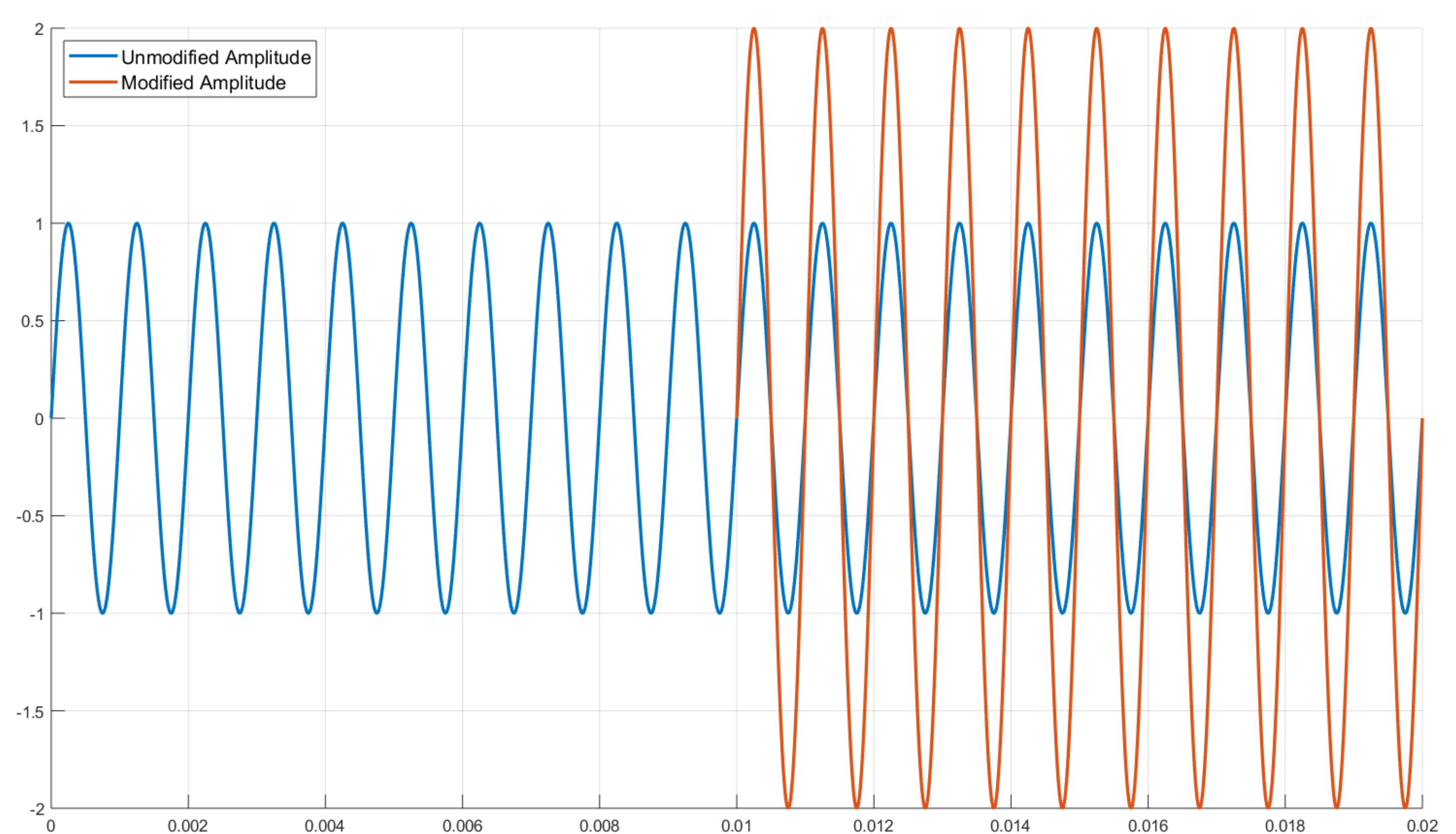


Figure 5: Reconfiguration of a BPSK Signal Source

Potential Deployment Areas

- Mixed-signal simulator enhancement ⇒ adding digital signal sources, DSP structures, matched filters etc.
- LinzFrame functionality providing through M/O ⇒ solver accessibility, efficient differential equation solving algorithms etc.
- Generic transmitter/receiver template generation