



AMD Vitis™ Design Implementation (GitHub)

Agenda

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1. Introduction to GitHub
 2. AMD Vitis™ DSP Library Overview
 3. Introducing AMD Vitis Tools Tutorials on GitHub
 4. What is a Polyphase Channelizer?
 5. Demo

Introduction to GitHub



What is GitHub

GitHub is a web-based platform for version control and collaborative software development

Uses Git for tracking changes in code

Centralized repositories for storing projects

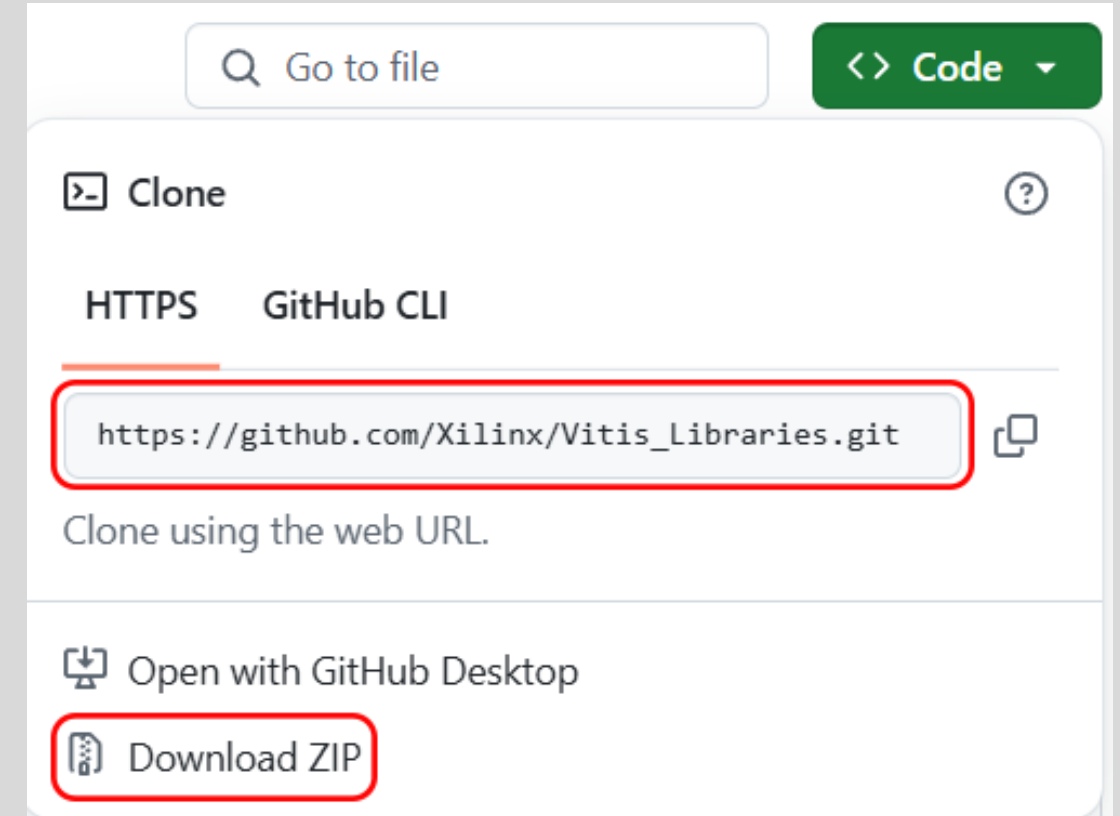
Key Concepts

Repository	Fork	Clone	Branch	Commit	Pull Request
Folder containing all project files	Create your own version of a project	Process of creating a local copy of a repository	Branches are parallel versions of a repository	Snapshot of the changes made to the files in a repository	Pull requests are a way to propose changes made on a branch to be merged into another branch

How to Download / Import Libraries from GitHub



- **Option 1:** Clone Repository
 - git clone
 - <https://github.com/username/repo.git>
- **Option 2:** Download ZIP
 - Code > Download ZIP > Extract files
- **Option 3:** GitHub Desktop (GUI tool)



AMD Vitis™ DSP Library Overview

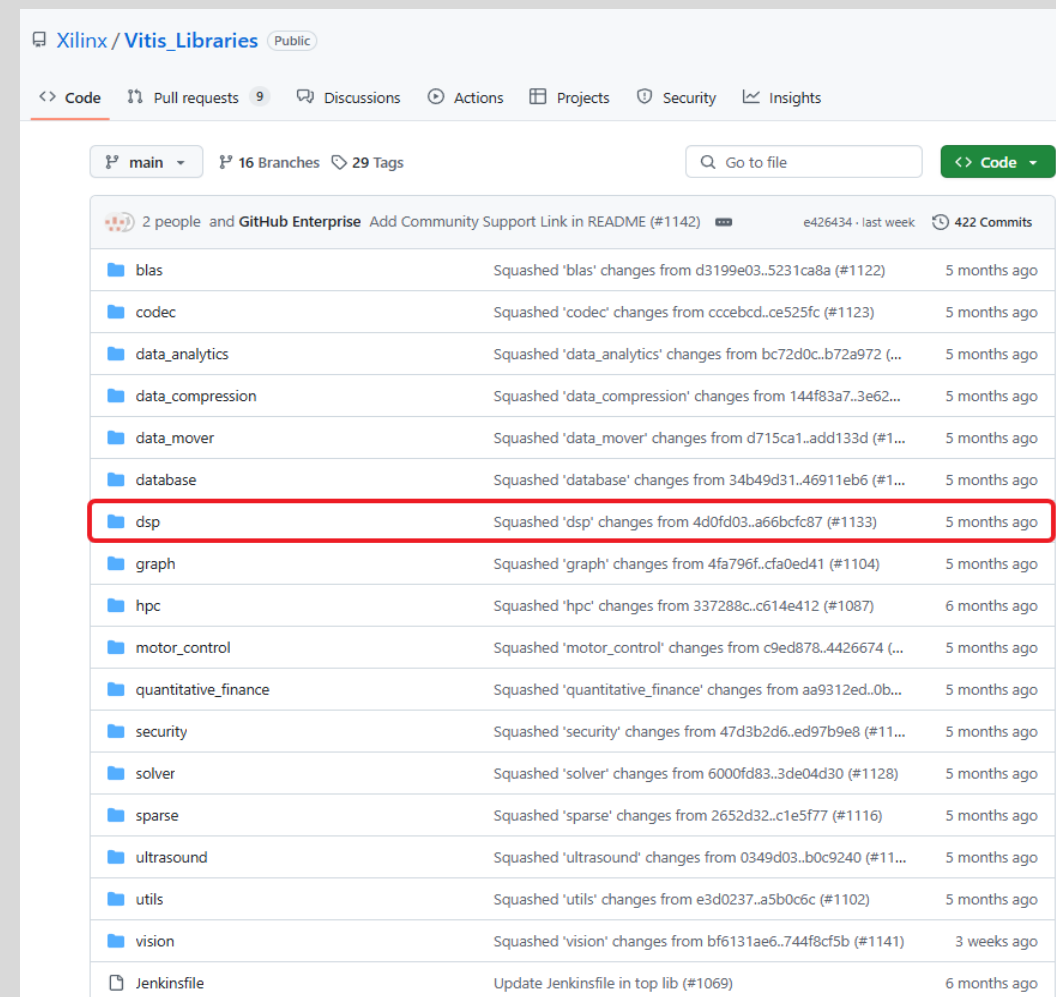
https://github.com/Xilinx/Vitis_Libraries

AMD Vitis™ DSP Library

PL DSP

AIE DSP

- Three types of implementations:
 - L1 PL primitives
 - L2 PL kernels
- Three types of implementations:
 - L1 AIE kernels
 - L2 AIE graphs and VSS makefiles



What Is the AMD Versal™ AI Engine DSP Library?

01



Configurable library of kernels to develop applications on AMD Versal™ AI Engines

02



Open-source library for DSP applications

03



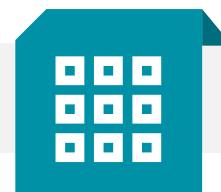
Kernels are coded in C++, and intrinsics give access to AI Engine vector processing capabilities

04



Kernels can be combined to construct graphs for developing complex designs

05



Example design is also provided with this library

06



Use the library element's graph as the entry point

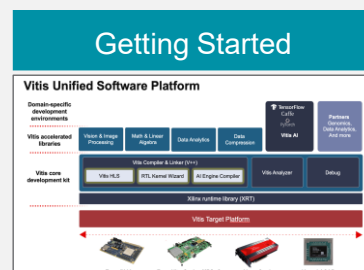
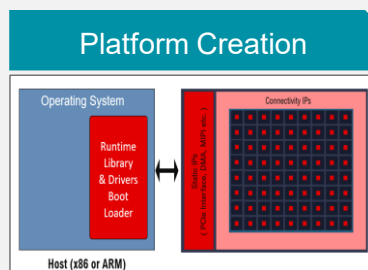
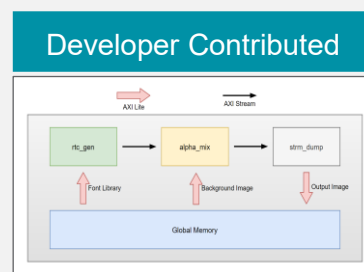
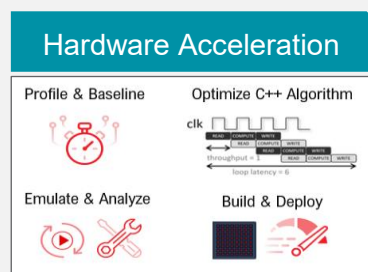
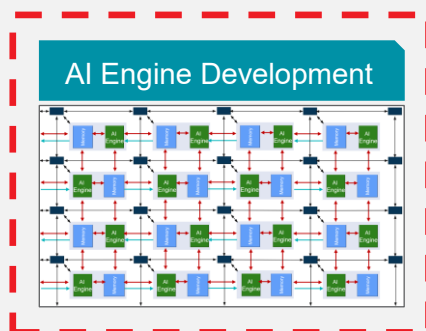
DSP Library Functions (Supports AIE and AIE-ML Devices)

[L2-AIE-DSP-Library-User-Guide](#)

Function	Graph Entry Point
Bitonic Sort	xf::dsp::aie::bitonic_sort::bitonic_sort_graph
Convolution / Correlation	xf::dsp::aie::conv_corr::conv_corr_graph
DFT	xf::dsp::aie::fft::dft_graph
FIR TDM	xf::dsp::aie::fir::tdm::fir_tdm_graph
Function Approximation	xf::dsp::aie::func_approx
Hadamard Product	xf::dsp::aie::hadamard::hadamard_graph
Kronecker	xf::dsp::aie::kronecker::kronecker_graph
Matrix Multiply	xf::dsp::aie::blas::matrix_mult::matrix_mult_graph
Matrix-Vector Multiply	xf::dsp::aie::blas::matrix_vector_mul::matrix_vector_mul_graph
Mixed Radix FFT	xf::dsp::aie::fft::mixed_radix_fft_graph

AMD Vitis™ Tools Developer Tutorials on GitHub

<https://github.com/Xilinx/Vitis-Tutorials>



Xilinx / Vitis-Tutorials Public

<> Code Issues 10 Pull requests Actions Projects Security Insights

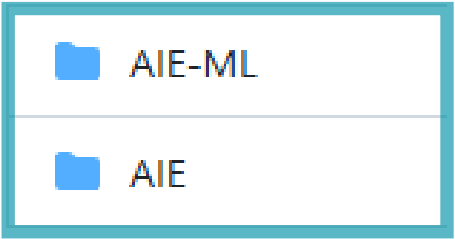
2024.2 13 Branches 1 Tag

Go to file Code

ca5ceb9 · 2 weeks ago 2,953 Commits

AI_Engine_Development	AIE/F/05: Update README.md	2 weeks ago
Developer_Contributed	DevContrib/01-thin-pfm:2024.2_next_ready_for_test	5 months ago
Embedded_Software	ES/F/02-Debugging: update version info, fix links	2 months ago
Getting_Started	PFM/G/vek280: remove unnecessary files	2 months ago
Hardware_Acceleration	TDL: Updating paths for HTML creation	10 months ago
Machine_Learning	TDL: Updated footer copyrights for Markdown files	2 years ago
Vitis_HLS	TDL: AIE 2024.2 document changes	3 months ago
Vitis_Platform_Creation	PFM/F/03_Vitis_Export_To_Vivado: Updated README for f...	2 months ago
docs-jp	TDL: Updating links to docs.amd.com	10 months ago
CHANGELOG.md	Doc: link new AIE feature tutorial	3 months ago
FAQs.md	READMEs: update to 2023.1	2 years ago
Jenkinsfile	Regression: Batch update PFM, BSP and CommonImages ...	7 months ago
LICENSE.txt	TDL: Updated footer copyrights for Markdown files	2 years ago
README.md	Doc: link new AIE and AIE-ML tutorial	2 months ago
index.rst	Updated top-level architecture files (READMEs and RSTs)	4 years ago

AMD Versal™ AI Engine Development Categories



Categories	Description
AIE-ML	The tutorials in the AIE-ML folder help you learn how to target, develop, and deploy advanced algorithms using an AMD Versal™ AI Edge Device that features an AIE-ML array in conjunction with PL IP/kernels and software applications running on the embedded processors.
AIE	The tutorials under the AIE folder help you learn how to target, develop, and deploy advanced algorithms using a Versal AI Core Device that features an AIE array in conjunction with PL IP/kernels and software applications running on the embedded processors. To successfully deploy AI Engine applications in hardware, you need to be aware of the AMD Vitis™ and AI Engine tools and flows.

Tutorial Structures

- The tutorials are divided into **categories**, with each category containing two **sections**.
- **Feature Tutorials**
 - Tutorials illustrate a specific feature or some advanced features that not all designs require but are still useful in special use cases.
- **Design Tutorials**
 - Tutorials illustrate higher-level concepts or design flows, walkthrough specific examples or reference designs. More complex and full designs may use multiple features of this subject.

Category

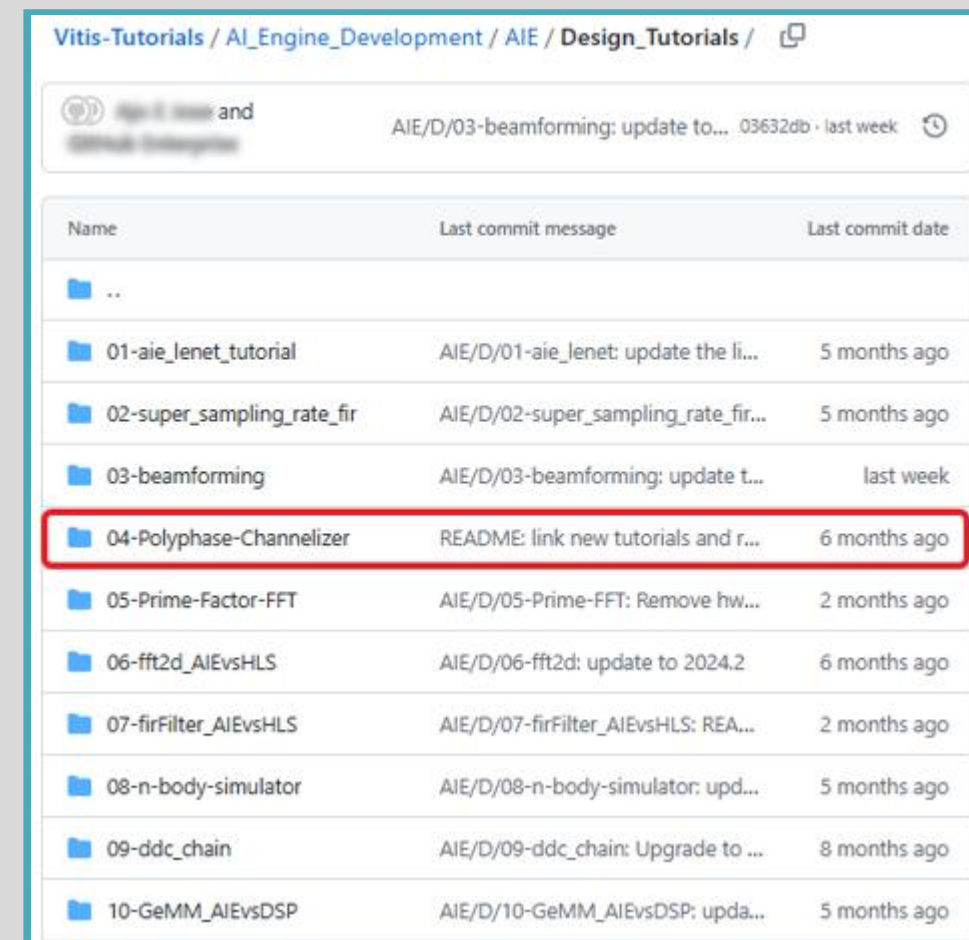
AI_Engine_Development
Developer_Contributed
Embedded_Software
Getting_Started
Hardware_Acceleration
Machine_Learning
Vitis_HLS
Vitis_Platform_Creation

Section

Design_Tutorials
Feature_Tutorials

Design Tutorials

- The AI Engine Development Design Tutorials showcase the two major phases of AI Engine application development: [architecting the application](#) and [developing the kernels](#).
- **Polyphase Channelizer**
 - This tutorial demonstrates an implementation of a system-level design (such as Polyphase Channelizer) using a combination of AI Engine and PL/HLS kernels.



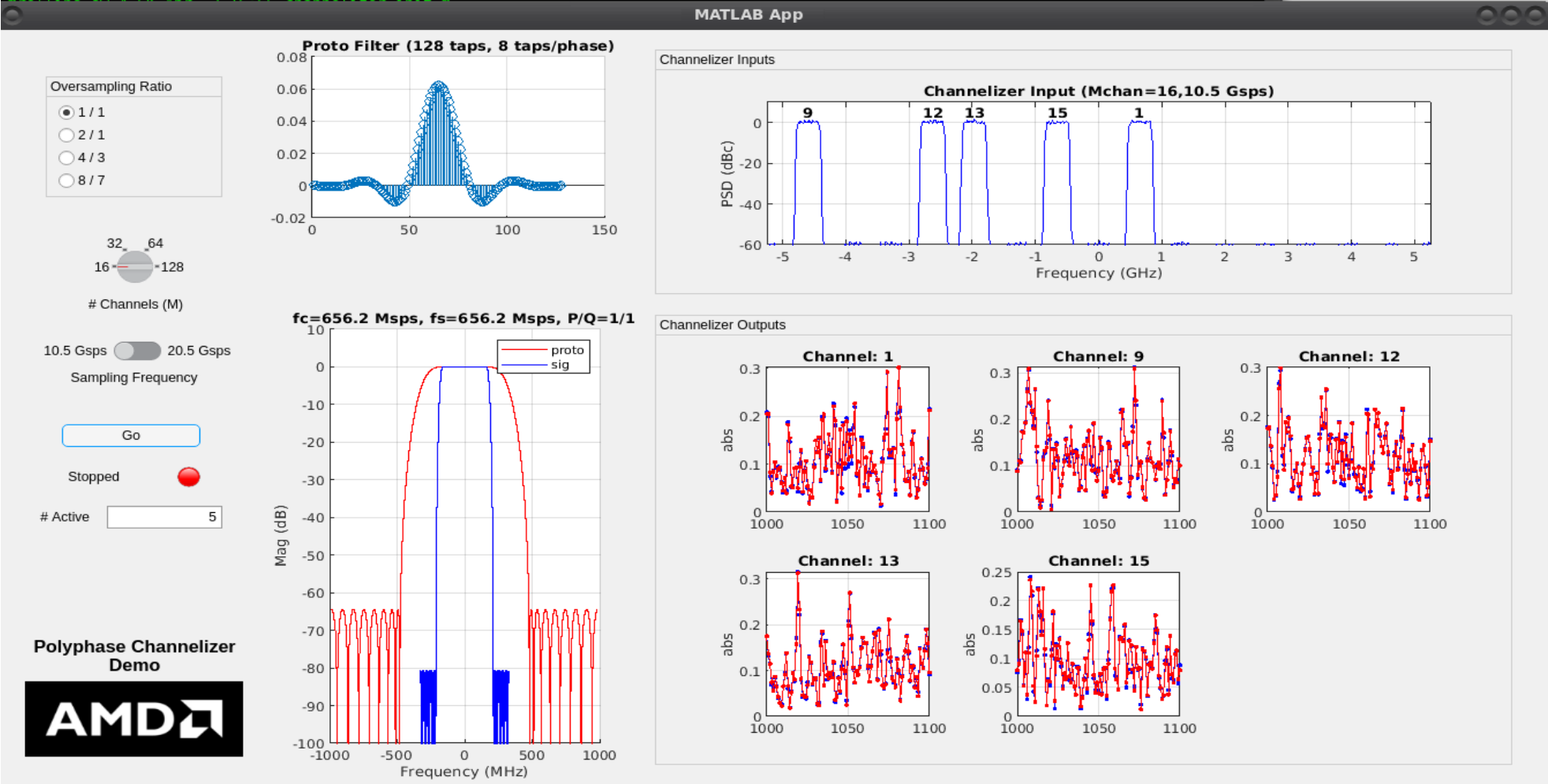
Vitis-Tutorials / AI_Engine_Development / AIE / Design_Tutorials /

AIE/D/03-beamforming: update to... 03632db · last week

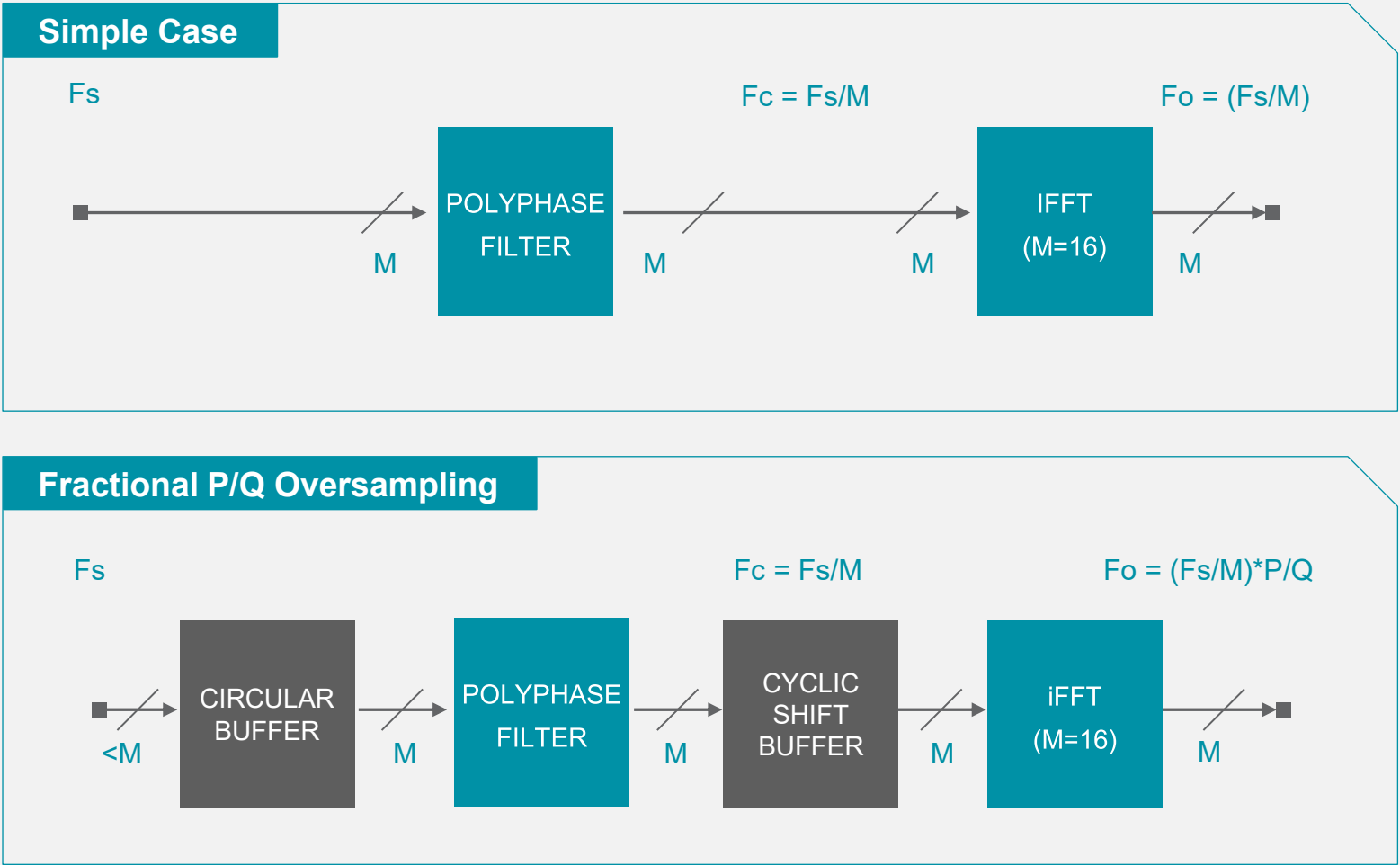
Name	Last commit message	Last commit date
..		
01-aie_lenet_tutorial	AIE/D/01-aie_lenet: update the li...	5 months ago
02-super_sampling_rate_fir	AIE/D/02-super_sampling_rate_fir...	5 months ago
03-beamforming	AIE/D/03-beamforming: update t...	last week
04-Polyphase-Channelizer	README: link new tutorials and r...	6 months ago
05-Prime-Factor-FFT	AIE/D/05-Prime-FFT: Remove hw...	2 months ago
06-fft2d_AIEvsHLS	AIE/D/06-fft2d: update to 2024.2	6 months ago
07-firFilter_AIEvsHLS	AIE/D/07-firFilter_AIEvsHLS: REA...	2 months ago
08-n-body-simulator	AIE/D/08-n-body-simulator: upd...	5 months ago
09-ddc_chain	AIE/D/09-ddc_chain: Upgrade to ...	8 months ago
10-GeMM_AIEvsDSP	AIE/D/10-GeMM_AIEvsDSP: upda...	5 months ago

What is a Polyphase Channelizer?

Down-converts several frequency-division multiplexed signals in parallel to baseband



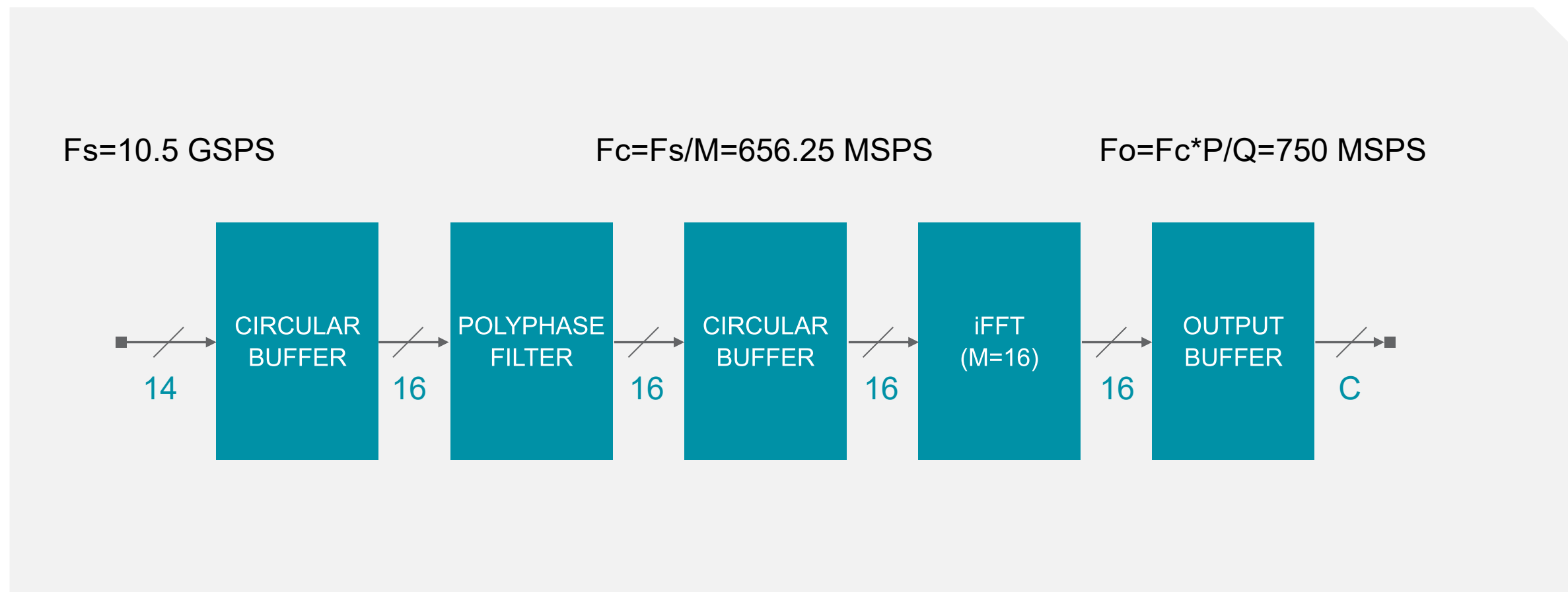
What is a Polyphase Channelizer?



Channelizer Design Specifications

Parameter	Value / Units
Input Sampling Rate (F_s)	10.5 GSPS
# of Channels (M)	16 Channels
Interpolation Factor (P)	8 n/a
Decimation Factor (Q)	7 n/a
Channel Bandwidth	656.25 MHz
Output Sampling Rate	750 MSPS
# of Taps per Phase (K)	8 n/a

Block Diagram of the Polyphase Channelizer



DEMO

<https://www.youtube.com/watch?v=4ndqWSCz4rw>

Summary

01

GitHub is a web-based platform using Git for version control and to track changes and store projects in repositories.

02

The AMD Vitis™ Digital Signal Processing Library offers L1 and L2 elements optimized for AMD FPGAs, adaptive SoCs (PL DSP library), and Versal™ AI Engines (AI Engine DSP library).

03

AMD Vitis tool tutorials are available on GitHub in the Vitis Tutorials repository, covering various categories like AI Engine Development and Hardware Acceleration.

04

A polyphase channelizer uses DSP techniques to down convert multiple frequency-division multiplexed signals to baseband in parallel.

05

The video demonstrates downloading the Vitis Tutorials ZIP file from GitHub, extracting it in Ubuntu®, navigating to the polyphase channelizer design directory.

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