Lightning Talk 5 - Detailed Design

Group sdmay25-16

Client: Manojit Pramanik
Advisor: Avishek Das

Project Overview

Problem Statement: Design and build an 8/16 channel amplifier with little noise to boost ultrasound signals received for the acoustic imaging system. Include casing for the multichannel system.

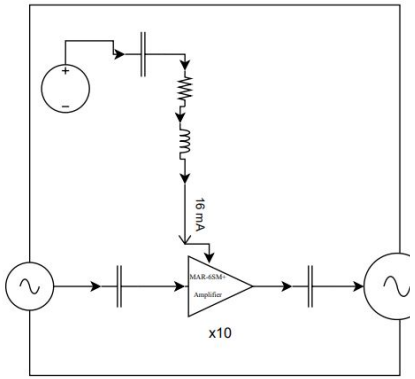
Constraints:

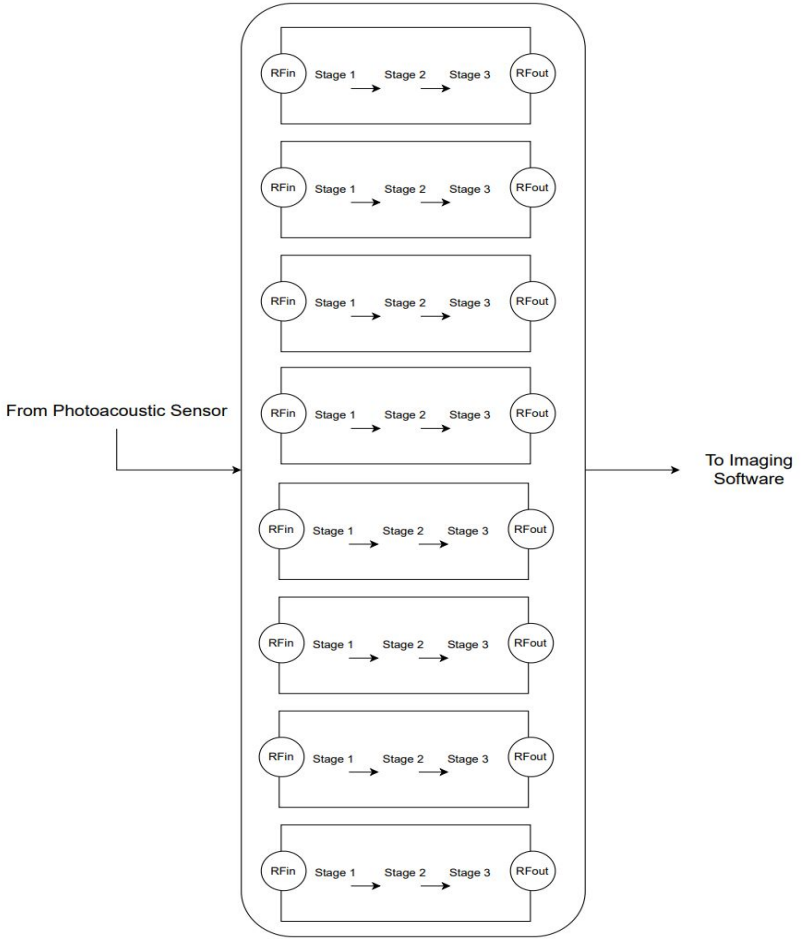
- Low noise
- Low input impedance
- Bandpass filtering: 10k-1MHz
- Low size (< 5x5 cm)
- ESD protection

Detailed Design

8 or 16 channels, each one with 3-4 stages of amplification. Each stage has a gain of 10 so our total gain is 100-1000 V/V. Capacitors filter and limit DC values, inductor keeps AC components out of the biasing source.

Each Stage:



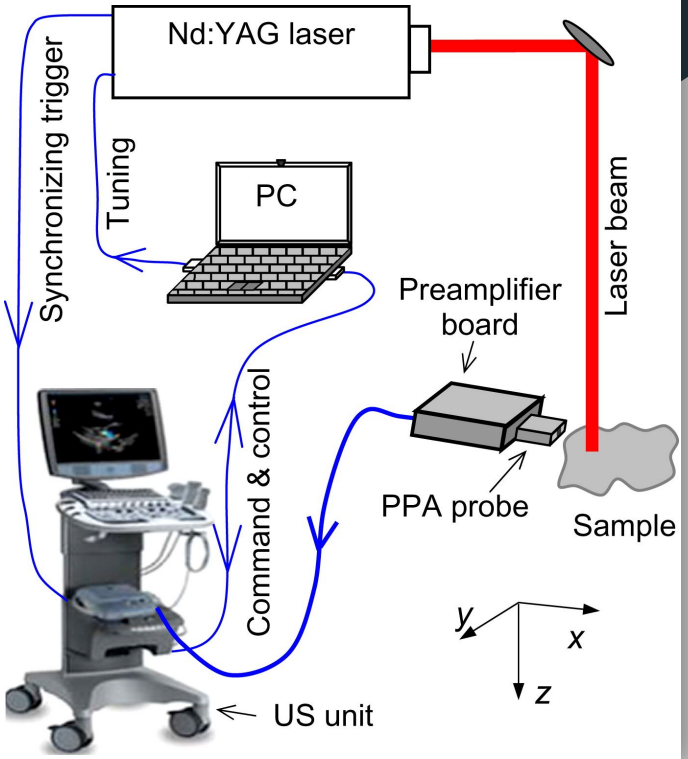


Functionality

- User would not have any direct contact with each amplifier board
- Plug the rf input and rf outputs into the sides of the encasement
- Power is supplied from the computer with the rf input and output
- Once signal is amplified, it will be sent back to the computer automatically for use with the imaging software
- Amplifier is able to be taken out of container and modified if needed

Technology Considerations

One of the biggest constraints is the use of a 5V power supply because of the limitations of the computer that is used in the lab. The computer also gives a limit of 10V on the output and anything higher could damage the computer which is very expensive. Something that we could implement to prevent this from happening is a fuse.



Areas of Concern and Development

Some challenges we are facing are:

- Getting the full 10x gain using the 5V power supply
- Filtering noise out without clipping the signal at higher voltages
- Preserving signal waveform integrity
- Limited accuracy of simulations

Conclusions

A good signal to noise ratio will provide more accurate images for the photoacoustic imaging system

Design must be modular with multiple channels

Areas of focus on design right now are getting a good gain while reducing noise transmission