IIR Filter IP

Kevin Bloom

Overview

□ System Design

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- ☐ System Design
- ☐ IIR IP

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- □ IIR IP
- □ Zynq Communication

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- ☐ System Design
- ☐ IIR IP
- ☐ Zynq Communication
- ☐ Example Outputs

System Design

Picture of the entire system, zoom in to see/explain things.

IIR IP

This frame will contain a picture of the IP. Discuss the I/O pins.

These frames will contain code snippets from the IP. Namely the important parts such as data (feedforward)/feedback input, arithmetic, data output, and the elaborated design.

IIR IP — Arithmetic

Arithmetic

Data Output

Big Picture, will need to zoom in.

☐ Single Stage vs BiQuad

☐ Single Stage vs BiQuad
☐ Floating Point to Fixed Point

☐ Single Stage vs BiQuad

☐ Floating Point to Fixed Point

☐ Gains and Scaling

- ☐ Number of coefficients increases dramatically

IIR IP — Single Stage Problems

- □ Number of coefficients increases dramatically
- □ Numerator coefficients approach zero

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- ☐ Numerator coefficients approach zero
- ☐ Denominator coefficients approach infinity

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```
Numerator:
0.067504806016373181
0.27001922406549272
0.40502883609823914
0.27001922406549272
0.067504806016373181
Denominator:
 1
-0.39064145319446159
 0.53430063715423204
-0.084233712203843125
 0.020651424506043823
```

IIR IP — Single Stage Problems

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```
Numerator:
0.00041659920440659937
0.0016663968176263975
0.0024995952264395961
0.0016663968176263975
0.00041659920440659937
Denominator:
 1
-3.1806385488747191
 3.8611943489942142
-2.1121553551109691
 0.43826514226197993
```

```
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0.067504806016373181
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0.27001922406549272
0.067504806016373181
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0.0016663968176263975
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Denominator:
 1
-3.1806385488747191
 3.8611943489942142
-2.1121553551109691
 0.43826514226197993
```

```
Numerator:
0.0047786506212785162
0.03822920497022813
0.13380221739579848
0.2676044347915969
0.33450554348849618
0.2676044347915969
0.13380221739579845
0.03822920497022813
0.0047786506212785162
Denominator:
 1
-0.79504924865005511
 1.316171195258671
-0.63488252768501452
 0.42215843994659008
-0.11480285264112501
 0.033379585260840769
-0.0039477257655511615
 0.00030769332294375583
```

```
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IIR IP — BiQuad

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- ☐ Small coefficient magnitudes
- ☐ Easy to make generic

Cons

- ☐ Numerator coefficients need scaled
- ☐ Requires more hardware

```
-------------------------
Section #1
-------------------------
Numerator:
1
2
1
Denominator:
 1
-0.22705028708083497
 0.4514083390923061
Gain:
0.30608951300286774
-------------------------
Section #2
-------------------------
Numerator:
1
2
1
Denominator:
 1
-0.16359116611362662
 0.045748876831938463
Gain:
0.22053942767957796
-------------------------
```

A discussion on why the coefficients need to be scaled. Probably will just contain pictures.

IIR IP — Scaling

A discussion on how to scale coefficients in MATLAB and the remaining issues with scaling.

Picture of the GPIOs that connect with the IPs, probably won't be using the mux/dmux design for this, so I'll be super basic. I might remove this entire section because it is so basic.

Snippet of the coefficient input process

Example Outputs — Lowpass

Picture of a lowpass filter, and the properties listed somewhere on here.

Picture of a highpass filter, and the properties listed somewhere on here.

Picture of a something else filter, and the properties listed somewhere on here.