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La Lobby

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CMLS 22/23, HOMEWORK #2

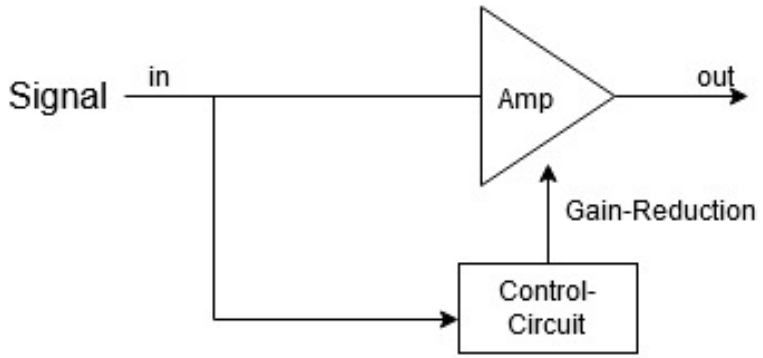
Analysis of *CTAG Dynamic Range Compressor* JUCE Implementation

CTAGDRC

The ***CTAG Dynamic Range Compressor*** is an easy-to-use compressor, suitable for any application.

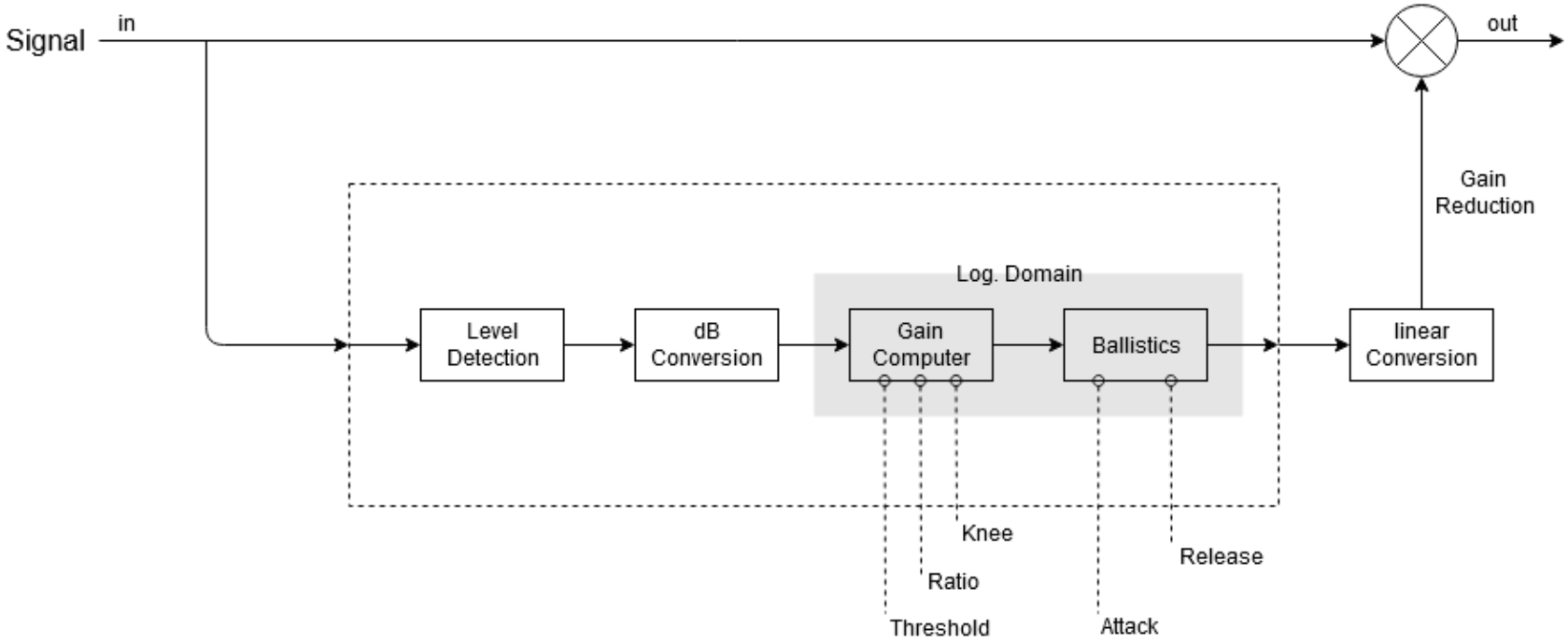
Topology

- Dynamic Range Compression (DRC) is the process of **mapping the dynamic range of an audio signal to a smaller range.**
- The topology chosen by the author of the plugin is the **feedforward** topology, whose scheme is illustrated below:



Control Circuit Architecture

The **control circuit** is structured as follows:



Level Detection

- The peaks are dectected in amplitude (***peak-sensing***).
- The signal is converted to **unipolar level** by taking its absolute value.
- The *maximum* between the two stereo channels is chosen.

Code 1. Unipolar level conversion and peak sensing.

```
1 FloatVectorOperations::abs(rawSidechainSignal, buffer.getReadPointer(0),
      numSamples);
2 FloatVectorOperations::max(rawSidechainSignal, rawSidechainSignal, buffer.
      getReadPointer(1), numSamples);
```

Domain Conversion

The gain computer and the application of the ballistics operate in the logarithmic domain.

- The conversion is executed by calling the *gainToDecibels()* function:

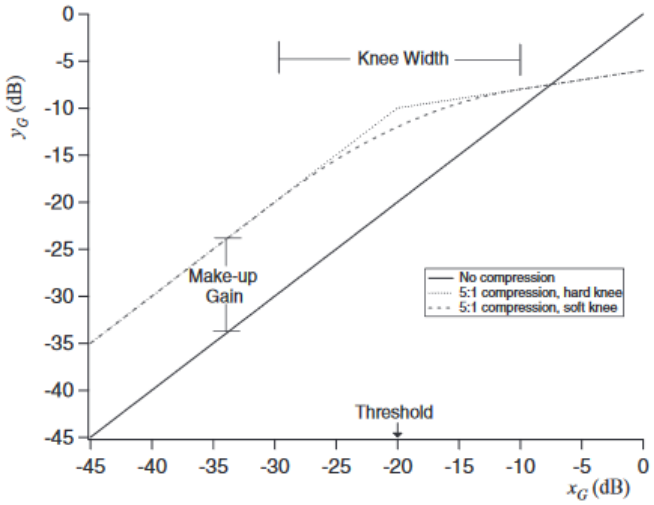
```
float levelInDecibels = Decibels::gainToDecibels(level);
```

- Its implementation is quite obvious:

```
float log  =  20 * std::log10 (gain);
```

Gain Computing and Ballistics

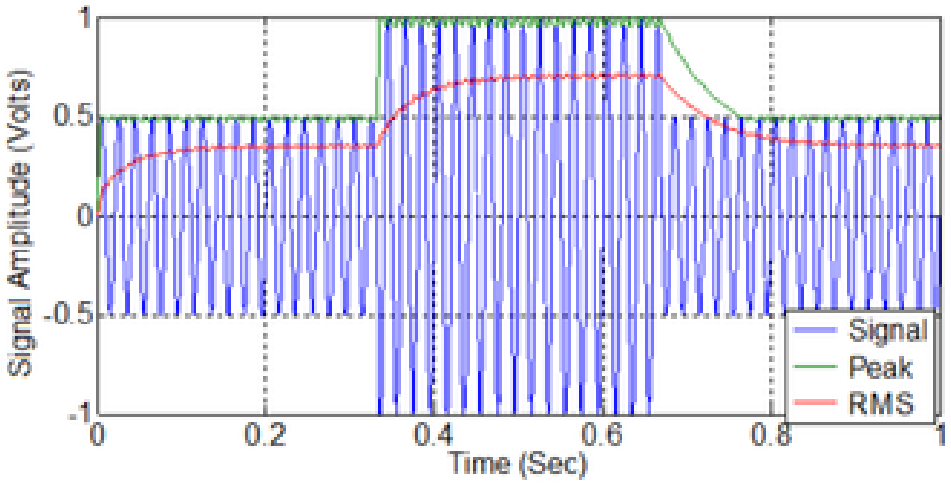
- The input/output features of the compressor are defined by means of three parameters: ***threshold***, ***ratio*** and ***knee***.



- After computing the gain, the **ballistics** (*attack* and *release*) are applied by a ***smoothing filter***.

Attack and Release Automation

The attack and release times can be automated using the ***crest factor*** of the input signal.

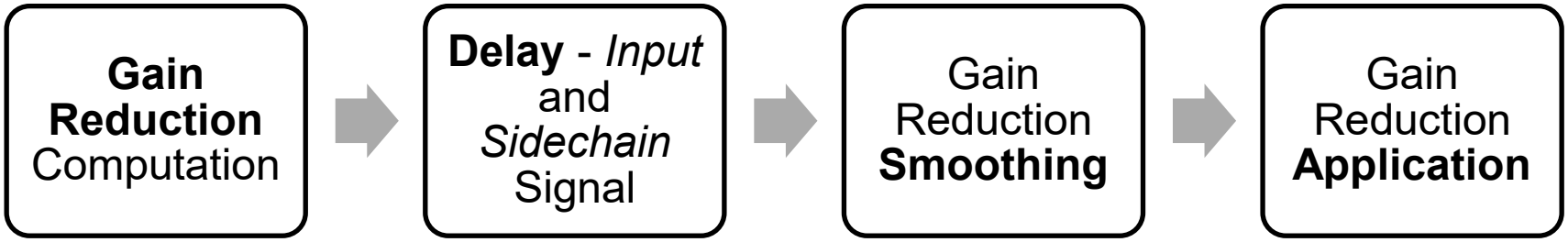


LookAhead Mode

- *LookAhead mode* allows the compressor to **anticipate incoming peaks** and effectively **operate on *very fast transients***.

- Most implementations are based just on *delaying the signal*, but this one has a peculiar feature: the gain reduction is **faded in slowly**, thus preventing any unwanted effects (*distortion*, *clicks*).

LookAhead Mode



- *Gain Reduction* ***Smoothing*** → application of a **time-reverse filter with a low-pass**.
- It is necessary to look for **local minima** (*negative peaks*) to compute the ***slope*** and consequently the next value of the fade-in.

Conclusions

- CTAG Dynamic Range Compressor is an example of a well built and efficient compressor.
- Its basic features are similar to the ones of other compressors.
- Its more advanced and interesting features allow non-expert users to easily and effectively employ the plugin.

Thank you for your attention

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