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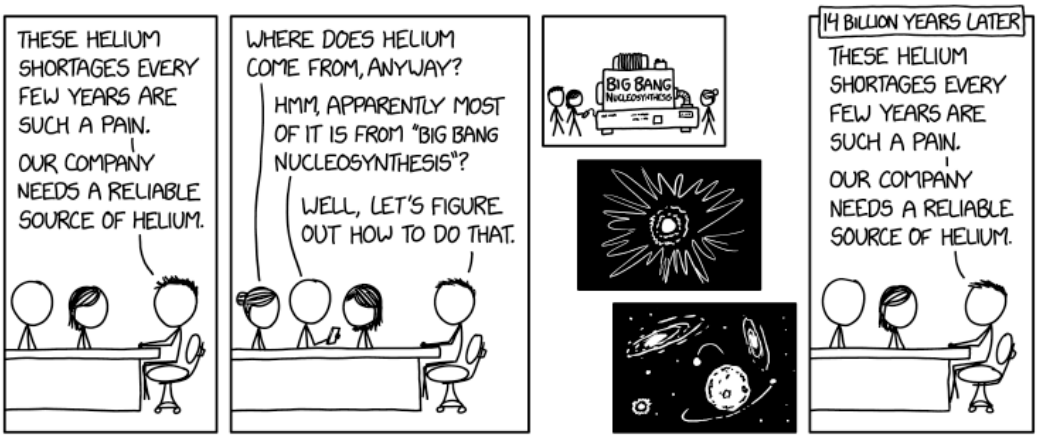
Course 22051: Signals and Linear Systems in Discrete Time

22051

/kæn aɪ rɪli duː ðæt/?

Individual assignment # 2 - Add/multiply/synthesize!



source: xkcd.com

Your entrance ticket to the final assessment

In order to join the final assessment, I will ask you to work during this semester on a solution of this individual assignment.

The basic idea is still that you won't be able to do much in the beginning of the course (How should you? You just started on DSP!). But as we progress, you will be able to start implementing certain elements - and continuously think about how to make the individual elements play together.

A key element in this project will be that you share knowledge. And you are not only encouraged to share knowledge within your own group, but I also highly encourage you to share knowledge **across groups**! Learn from each other how these problems can be tackled - and then find your own way to implement them! **Share knowledge, not code!**. You need to submit your solution individually at the beginning of week 10. Copying code or text is plagiarism and can not be accepted. But please go ahead and chat!

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1 The assignment

Good job with the coffee mugs! With some training you will even be able to figure out who just put their cup into the kitchen sink rather than into the dishwasher. Good results lead to bigger tasks! So now comes the management. They heard about your splendid DSP skills and now want to give you another cool task for which they even take off all the annoying administrative things off your desk. Nice!

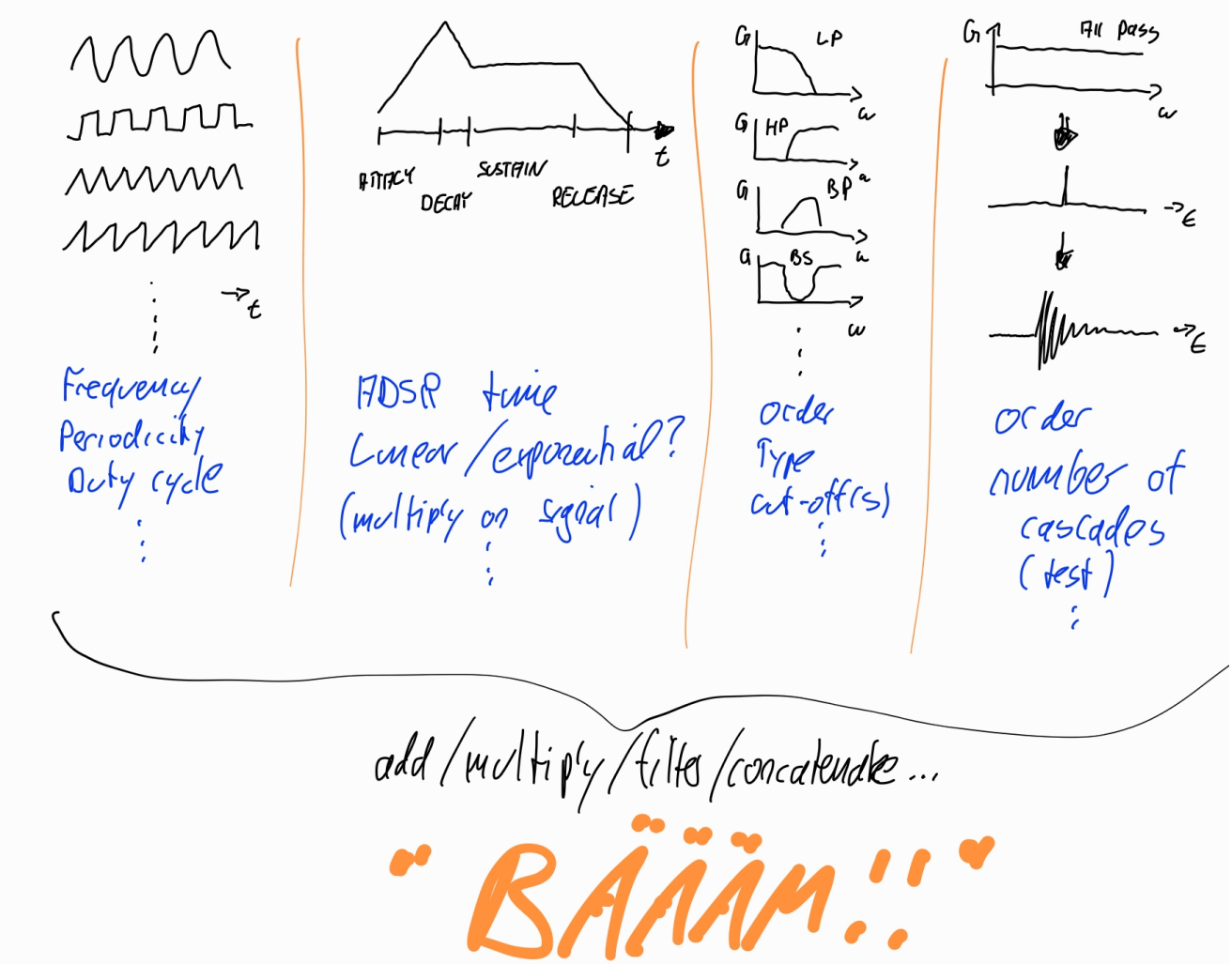
A dude in a bad sitting (and slightly dusty) suit enters your office with a device in his hands. You can see that is was a synthesizer which looks a bit ragged at the edges. You older colleagues immediately tell you about the "good old times" where synth-jams spiced up all the friday bars and Christmas parties. So you are to re-vive that - but in-silico (and we don't need realtime processing for a start)!

The basic components of a synthesizer are a) a function generating sinusoids/trains of square waves/triangles/saw tooths, b) an ADSR-envelope generator with "Attack/Decay/Sustain/Release", and c) a filter element (low-/high-/band pass), and d) an all-pass filter. Then you just mix (multiply/add) stuff up and BAM - you create cool sound effects! Too many high frequencies? Apply a low-pass filter! Not enough "ooomph"? Boost lower frequencies or modulte with a low-frequency sound. Needs to be more "rough"? Try square wave instead of sinusoid. More techno-like? Send a pulse train through a cascade of many (!) all-pass filters!

Prepare a MATLAB LIVESCRIPT or a JUPYTER NOTEBOOK that includes all these elements with some relevant parameters (use functions). Add comments and guide step-by-step through your individual elements and provide an example for each part. Add plots on the way to show what you are doing and justify your choice of parameters. Generate some cool sound sample (could be an explosion, a beat of a techno sound, some light saber sound effect - doesn't matter, as long as it sounds cool) and explain what you did, what type of sound you designed, and what you hear (and why). Store the final sound file.

The assignment is to be provided as MATLAB LIVESCRIPT or as JUPYTER NOTEBOOK in a .zip file tha includes the relevant folder structure and all relevant files. I will need to be able to unzip and run the code.

Sketchy...



How to get it done

If you need support, then please reach out to your network (the other groups) and post questions etc. on the communication channel. Feel free to post code on DTU LEARN - and see how others solve the problem. You will find your own way of implementing it - and this is what we will be discussing during the next weeks. You are also welcome to bring up some specifics during the weekely small-group discussions where we can tackle things specifically.

Good luck!

Acknowledgements

This project assignment is the result of teamwork - with essential contributions from enthusiastic students that are interested in improving teaching for the generations to come.