



## ECAM ENGINEERING PROGRAMME

Academic Year: 2022/23  
Examination Period: Semester 2

Name: \_\_\_\_\_ Surname: \_\_\_\_\_

Year group: EENG3
Teaching Unit Name: Robotics & Automation course
Module Title: Signal processing (Retake)
Date: July 19 <sup>th</sup> 2023
Time Duration: 2 Hours
Examiner(s): Guillaume Gibert

### INSTRUCTIONS TO CANDIDATES:

Write on:	■ Authorised documents:	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
▪ <i>The answer booklet.</i>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	If YES, please specify: all documents
▪ <i>The examination paper.</i>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>	■ At the end of the examination, hand in:
■ Authorised calculator	YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>	▪ The examination paper: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>
Laptop, tablet, calculator	▪ Rough Work	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>

Candidates can use any document, laptop, tablet and calculator.

Candidates must use Octave to analyse the provided signal.

Candidates must write a report using the provided template. The document should be converted to pdf before submission on Moodle.

**Do not turn this page over until instructed to do so by the Invigilator.**

## **Problem**

As an expert in signal processing, you are asked to analyse the content of an unknown signal. Very little information is available concerning this mysterious signal. You only have access to:

- The sampling frequency  $F_s = 650 \text{ Hz}$ ;
- The signal is composed of a linear combination of 2 sine waves that may evolve over time and white noise;
- A csv file containing the mysterious signal to study.

Your goals are:

1. To analyse the content of this signal i.e. extract the different components embedded in the signal using various signal processing techniques (e.g. windowing, spectral analysis).

## **Instructions**

Go to moodle.ecam.fr -> Signal processing + Wireless communications -> Retake exam 2023 -> Documents

Download the csv file: **unknownsignal.csv**

Open Octave

Load the csv file using the following command: **signal = csvread('unknownsignal.csv');**

The variable **signal** is an array of double that contains the signal to analyse.

Use signal processing techniques to analyse and filter the unknown signal such as:

- windowing (standard window functions are available in Octave e.g. rectangular, hamming...)
- spectral analysis (dft, fft, spectrogram, wavelets...)
- filtering (several functions are available such as filter(), fir1(), butter()...)

Analyse the signal and write down the methods you followed and the results you obtained as a report (i.e. with an introduction and a conclusion) using the template document.

You may include figure(s) in your report.

Provide the code you used to analyse and filter the signal in the appendix of the document and as a git link as well.

Convert the document as a pdf file before submitting it on Moodle.

## **Documentation**

Octave: [https://octave.sourceforge.io/list\\_functions.php](https://octave.sourceforge.io/list_functions.php)

Signal package: <https://octave.sourceforge.io/signal/overview.html>