

CX1104: Linear Algebra for Computing

$$\underbrace{\begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix}}_A \underbrace{\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_n \end{bmatrix}}_x = \underbrace{\begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{bmatrix}}_b$$

Chap. No : **8A.0**

Lecture : **Complex Numbers**

Topic : **Overview of this chapter**

Concept :

Instructor: **A/P Chng Eng Siong**

TAs: **Shreyas Gopal**

Content

8A.1.0: Overview

8A.1.x: Introduction to complex numbers+ Arithmetic Operations + Eulers formula (1.5 hour)

- definition and motivation
- geometric interpretation
- rectangular and Polar form
- add, subtract, multiply, and divide,

8A.2.x: Complex exponential form (1.5 hour)

DeMoivre's Theorem: power and roots of complex number, n^{th} root of unity

8A.3.x: DFT transformation matrix W and $e^{j\omega n}$ (3 hours)

- introducing $x \in \mathcal{C}^n = [e^{j\omega n}]$ a complex sequence vector with N elements
- scaling αx , where $\alpha \in \mathcal{C}$
- introducing Fourier basis DFT W matrix and its inverse:
 - Analysis : $X = Wx$: if A is square, this can be viewed as a change of basis (analysis)
 - Synthesis: $x = \frac{1}{N} W^H X$

References Complex numbers: some notes and YouTube

1) CUHK: https://www.math.cuhk.edu.hk/course_builder/1920/math1510d/C10_ComplexNumber.pdf

2) Paul Lamar online primer: <https://tutorial.math.lamar.edu/Extras/ComplexPrimer/ComplexNumbers.aspx>,
<http://tutorial-math.wip.lamar.edu/Classes/Alg/ComplexNumbers.aspx>

3) Harvey Mudd: <https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/prec calculus/complex-numbers/#top>

4) Some Chapters on complex numbers:

A. <https://ncert.nic.in/ncerts/l/kemh105.pdf>

B. https://www.cimt.org.uk/projects/mepres/alevel/fpure_ch3.pdf

C. <https://ms.mcmaster.ca/~vantuyl/courses/oldcourses/Chap10.pdf>

5) Online courses:

A. Petra's Week1,Lect 1~4: https://www.youtube.com/watch?v=CVpMpZpd-5s&list=PLi7yHjesbIV0sSfZzWdSUXGO683n_nJdQ

B. Professor Dave Explains:
https://www.youtube.com/watch?v=Yddjxj49C_M

C. MIT Gilbert Strang:
<https://www.youtube.com/watch?v=Jkv-55ndVYY>

D. Oxford Vicky Neale: An Intro to Complex Numbers
<https://youtu.be/BP7Ujbyu-NE>

E. Steve Brunton: Complex Analysis L01:
https://www.youtube.com/watch?v=_mv0q7-WF4E

