

# MA2252 Introduction to computing

lectures 1-2

Introduction and MATLAB essentials

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# What is computing?

- ▶ Carry out (large) calculations aided by a machine (computer).
- ▶ Computers → **process** and **display** information.

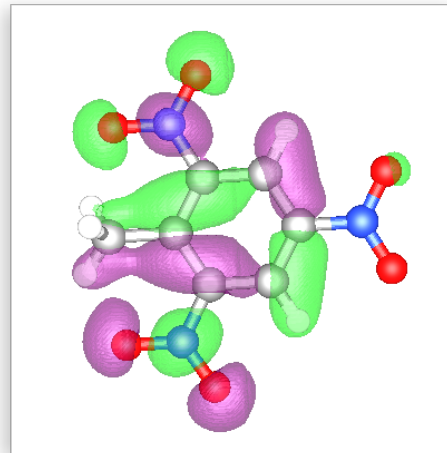
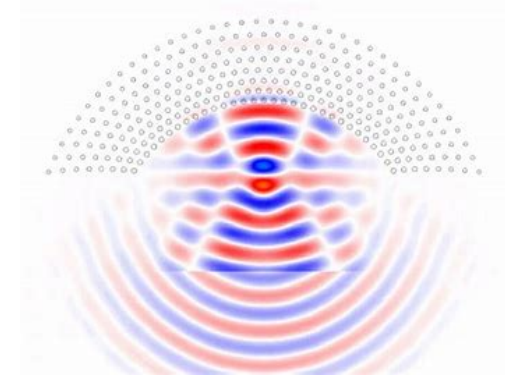
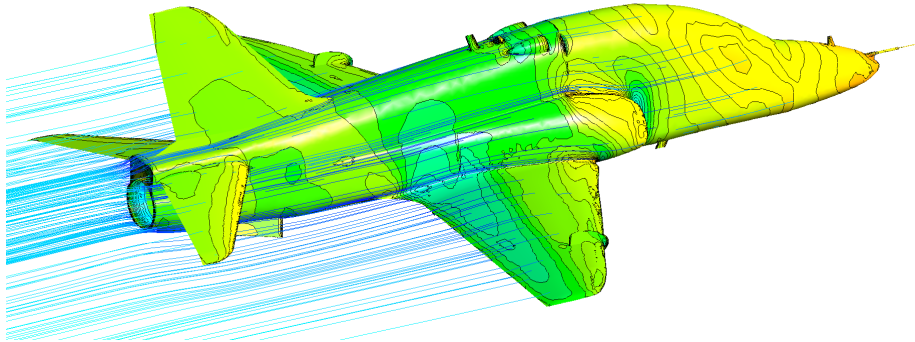
Example of a program:

*Find all integers between 1 and  $10^6$  that are divisible by 13.*

# Why is it important?

## Essential tool for any applied mathematician

- Solving PDEs – scientific computing



- Optimisation
- Artificial intelligence
- Finance

# Why is it important?

**Also important to pure mathematicians**

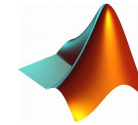


Alain Connes (Fields Medallist): *"I work with the computer a lot"*

How?



# MATLAB = MATrix LABoratory



$$\begin{matrix} & \xrightarrow{n=3} \\ m=4 \downarrow \begin{bmatrix} 2.1 & 7.9 & 8.4 \\ 3.0 & 4.5 & 2.3 \\ 12.2 & 6.6 & 8.9 \\ 1.8 & 1.3 & 8.2 \end{bmatrix} \end{matrix}$$



- ▶ User-friendly interface
- ▶ Provides tools for visualising data
- ▶ Includes large collection of built-in functions
- ▶ Easy matrix manipulations

In this course we focus on algorithms and computing only. **No object oriented programming.**

# Course organisation



# MATLAB installation

Two options:

- ▶ Work off-line (desktop).
- ▶ Work with MATLAB online.

go here: <https://uk.mathworks.com/academia/tah-portal/university-of-leicester-30980861.html>



# The MATLAB environment

- ▶ Command window/prompt
- ▶ MATLAB workspace.
- ▶ **help** (very useful!).

# MATLAB as a calculator

- ▶ Typical operations:

+

-

\*

/

^

- ▶ Standard order of operations. Can be altered with the use of the parentheses '()'.
  - ▶ Many Build-in functions: sin, cos, exp, log, log 10, sqrt
  - ▶ Standard rules for composition of functions.
  - ▶ Complex numbers, e.g.  $1 + 2i$ .

# Logic expressions and operations

A logical expression is a statement that can be true or false. The result are **booleans** type of 'variables':

- ▶ true = 1
- ▶ false = 0

		Q	
		1	0
P	1	1	0
	0	0	0
		AND	

		Q	
		1	0
P	1	1	1
	0	1	0
		OR	

Operations:

- ▶ AND: '&&'
- ▶ OR: '||'
- ▶ NOT: '~'
- ▶ Comparison: '>', '<', '>=', '<=', '==', '~='

# Order of operations

Decreasing order of precedence:

- ▶ Parantheses ()
- ▶ Exponentiation ^
- ▶ Logical negation ~
- ▶ Multiplication \* and Division /
- ▶ Addition + and Subtraction -
- ▶ Comparison operators
- ▶ &&
- ▶ ||

**Note:** MATLAB executes operators with same order of precedence from left to right.

In MATLAB, what does the expression  $A||B\&\&C$  means? A, B, and C are logical expressions.

## Other classes of elements in MATLAB

**'double', 'char', 'int', 'NaN', 'inf', etc.**

**For 'double':**

- ▶ **Format long** = displays 16 digit of accuracy
- ▶ **Format short** = displays 4 digits
- ▶ **Format bank** = displays 2 digits