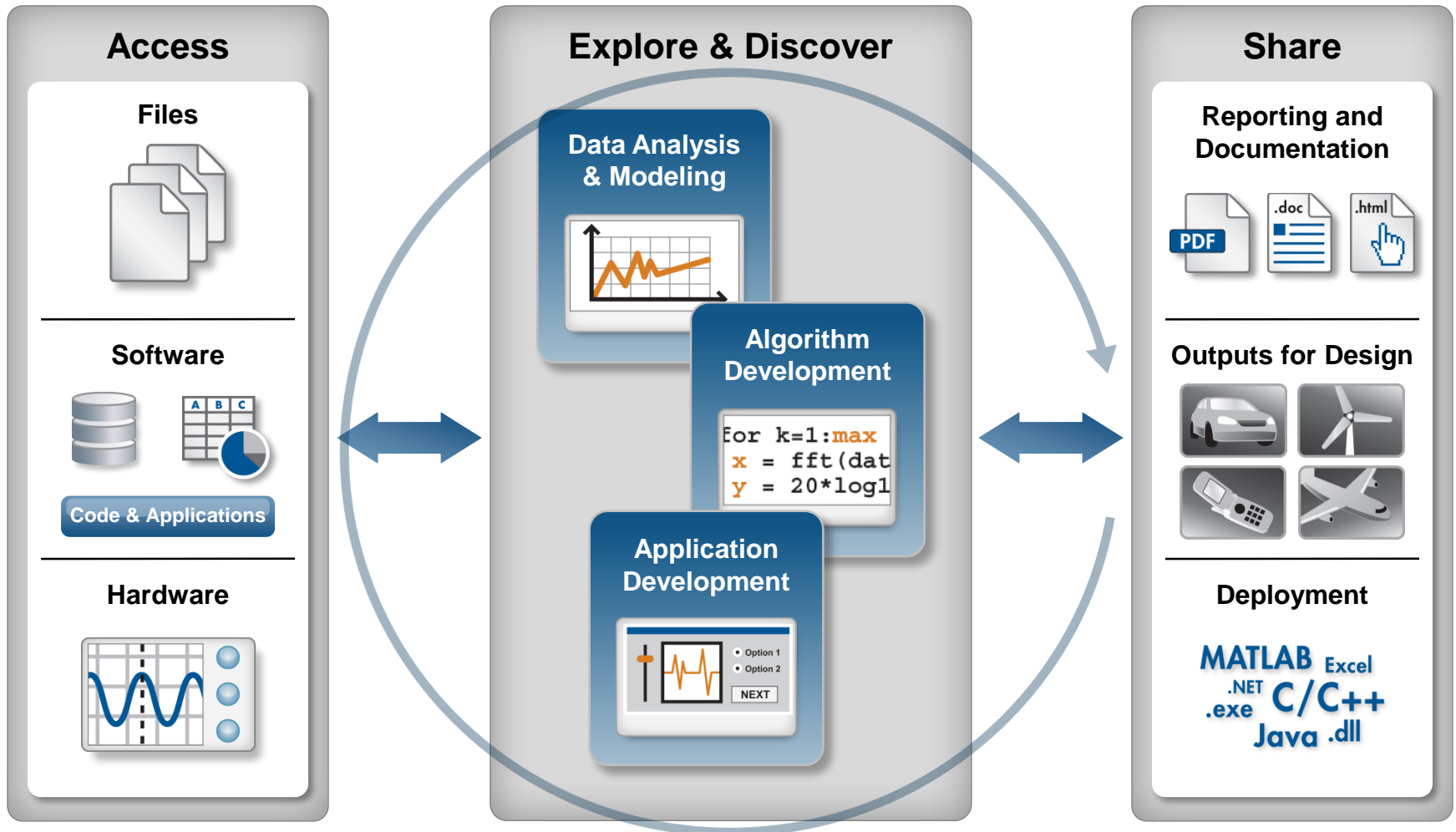


# Introduction to Data Analysis in MATLAB

- Bring data into MATLAB from Excel and text files, databases and devices
- Visualize, process and analyze data
- Automate data analysis and create reports

**Kameswarie Nunna, PhD**  
Academic Technical Specialist  
MathWorks

# Technical computing workflow



Automate

*Flutter = bad*



# *Flutter = really bad*

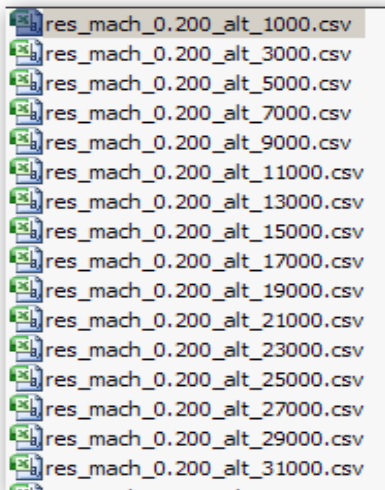


# Flutter suppression controller analysis

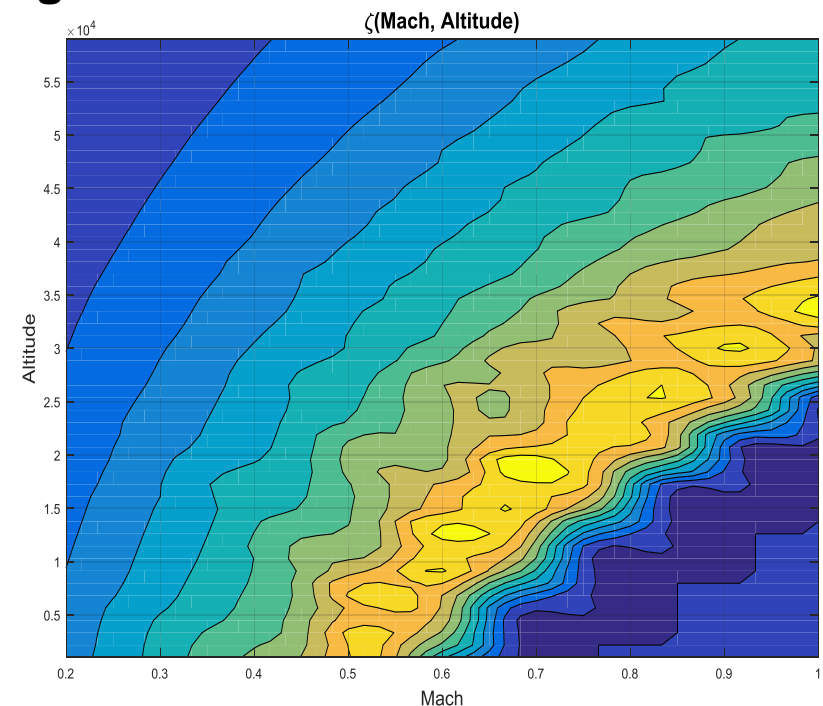
## Challenge:

*Find stability boundary of flutter suppression controller*

- Model **damping ratio** of sensor position as function of **Mach** and **altitude**
- Test data in 330 spreadsheets (for varying **Mach** and **altitude**)
- For each dataset need to compute **damping ratio**



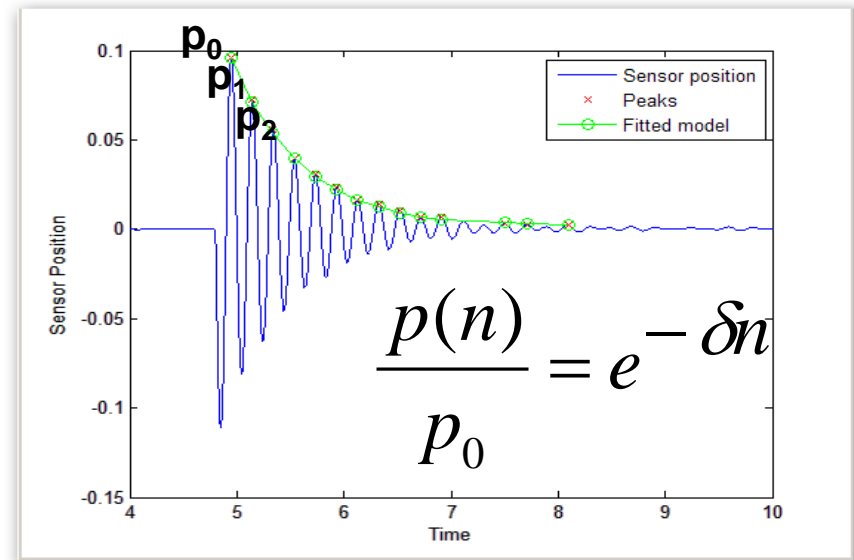
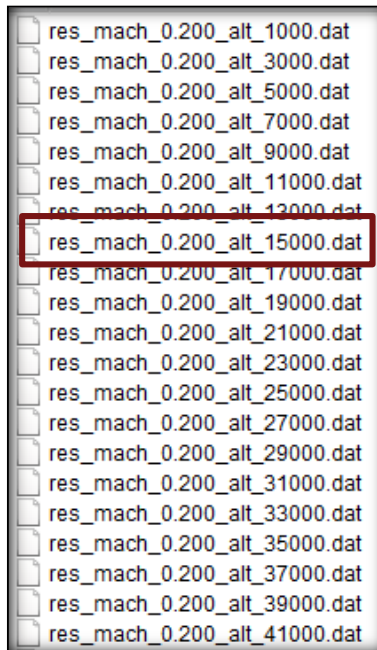
```
res_mach_0.200_alt_1000.csv  
res_mach_0.200_alt_3000.csv  
res_mach_0.200_alt_5000.csv  
res_mach_0.200_alt_7000.csv  
res_mach_0.200_alt_9000.csv  
res_mach_0.200_alt_11000.csv  
res_mach_0.200_alt_13000.csv  
res_mach_0.200_alt_15000.csv  
res_mach_0.200_alt_17000.csv  
res_mach_0.200_alt_19000.csv  
res_mach_0.200_alt_21000.csv  
res_mach_0.200_alt_23000.csv  
res_mach_0.200_alt_25000.csv  
res_mach_0.200_alt_27000.csv  
res_mach_0.200_alt_29000.csv  
res_mach_0.200_alt_31000.csv
```



# Flutter suppression controller analysis

## Approach:

- Compute damping ratio for a signal in a single file
- Save the processing routines as a script



$$\text{Damping ratio } \zeta = \frac{\delta}{\sqrt{(2\pi)^2 + \delta^2}}$$

# Flutter suppression controller analysis

## Approach:

- Compute damping ratio for signal in a single file
- Save the processing routines as a script
- **Compute ratio for each file using batch processing**
- **Model the result**

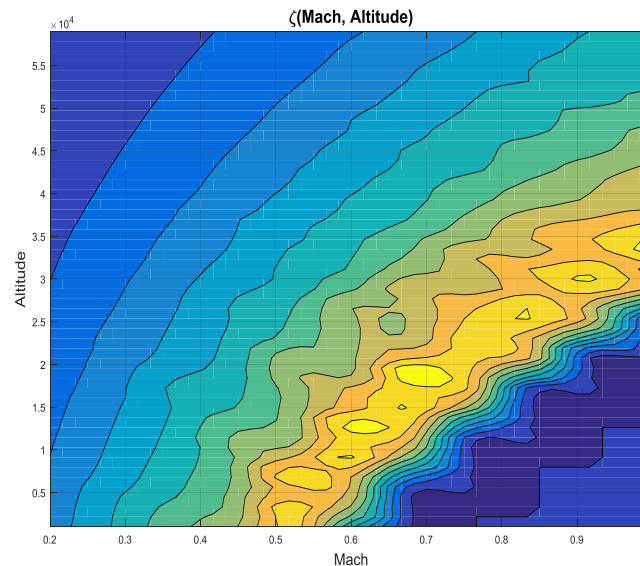
330 data files with varying Mach and Altitude

Damping ratio as a function of Mach and Altitude

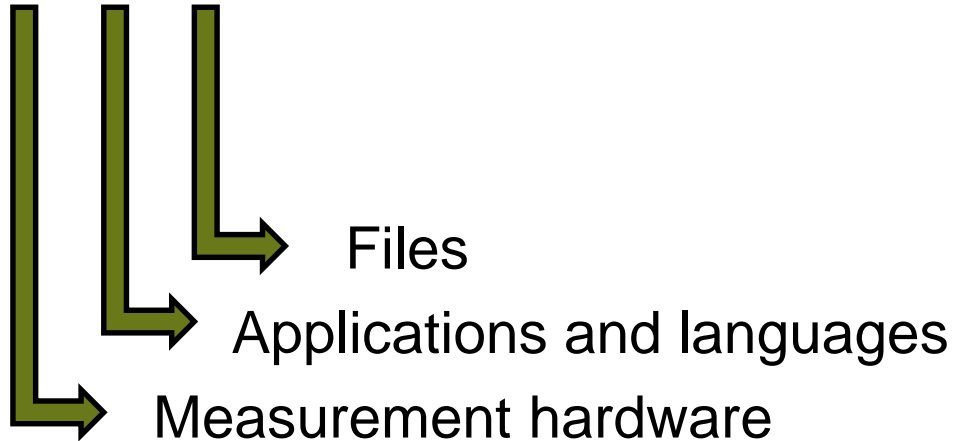
Report to share

```

res_mach_0.200_alt_1000.dat
res_mach_0.200_alt_3000.dat
res_mach_0.200_alt_5000.dat
res_mach_0.200_alt_7000.dat
res_mach_0.200_alt_9000.dat
res_mach_0.200_alt_11000.dat
res_mach_0.200_alt_13000.dat
res_mach_0.200_alt_15000.dat
res_mach_0.200_alt_17000.dat
res_mach_0.200_alt_19000.dat
res_mach_0.200_alt_21000.dat
res_mach_0.200_alt_23000.dat
res_mach_0.200_alt_25000.dat
res_mach_0.200_alt_27000.dat
res_mach_0.200_alt_29000.dat
res_mach_0.200_alt_31000.dat
res_mach_0.200_alt_33000.dat
res_mach_0.200_alt_35000.dat
res_mach_0.200_alt_37000.dat
res_mach_0.200_alt_39000.dat
res_mach_0.200_alt_41000.dat
    
```

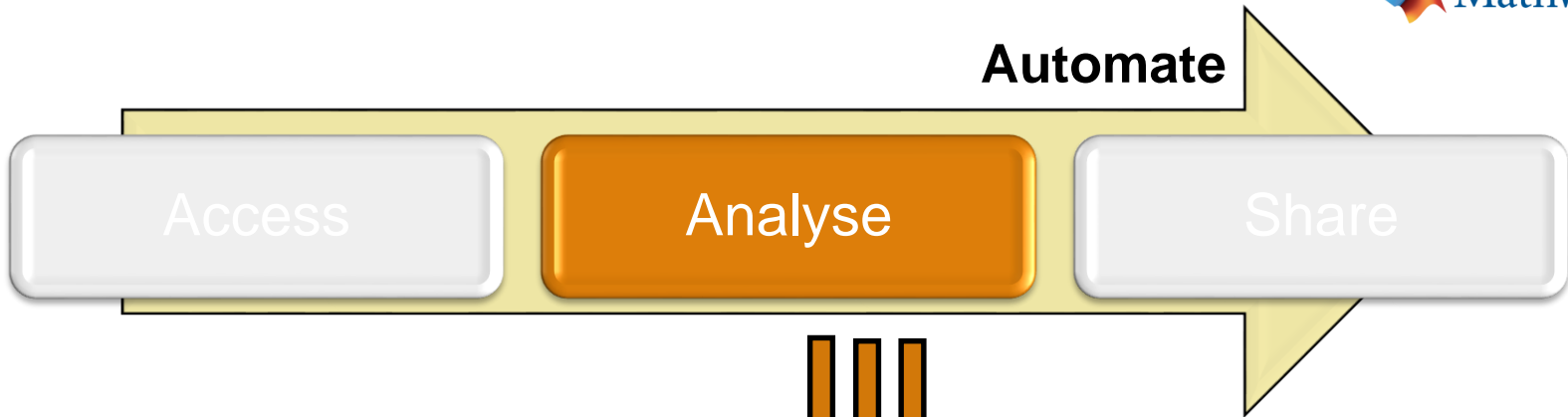


Automate



- res\_mach\_0.200\_alt\_1000.dat
- res\_mach\_0.200\_alt\_3000.dat
- res\_mach\_0.200\_alt\_5000.dat
- res\_mach\_0.200\_alt\_7000.dat
- res\_mach\_0.200\_alt\_9000.dat
- res\_mach\_0.200\_alt\_11000.dat
- res\_mach\_0.200\_alt\_13000.dat**
- res\_mach\_0.200\_alt\_15000.dat
- res\_mach\_0.200\_alt\_17000.dat
- res\_mach\_0.200\_alt\_19000.dat
- res\_mach\_0.200\_alt\_21000.dat
- res\_mach\_0.200\_alt\_23000.dat
- res\_mach\_0.200\_alt\_25000.dat
- res\_mach\_0.200\_alt\_27000.dat
- res\_mach\_0.200\_alt\_29000.dat
- res\_mach\_0.200\_alt\_31000.dat
- res\_mach\_0.200\_alt\_33000.dat
- res\_mach\_0.200\_alt\_35000.dat
- res\_mach\_0.200\_alt\_37000.dat
- res\_mach\_0.200\_alt\_39000.dat
- res\_mach\_0.200\_alt\_41000.dat





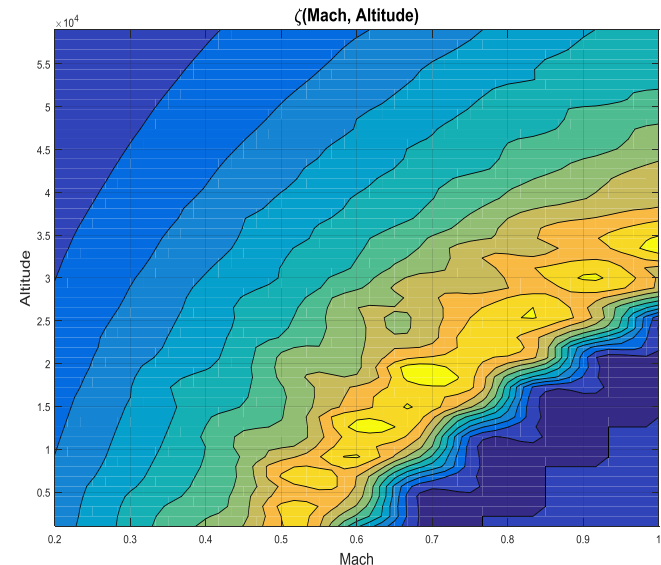
- Data analysis

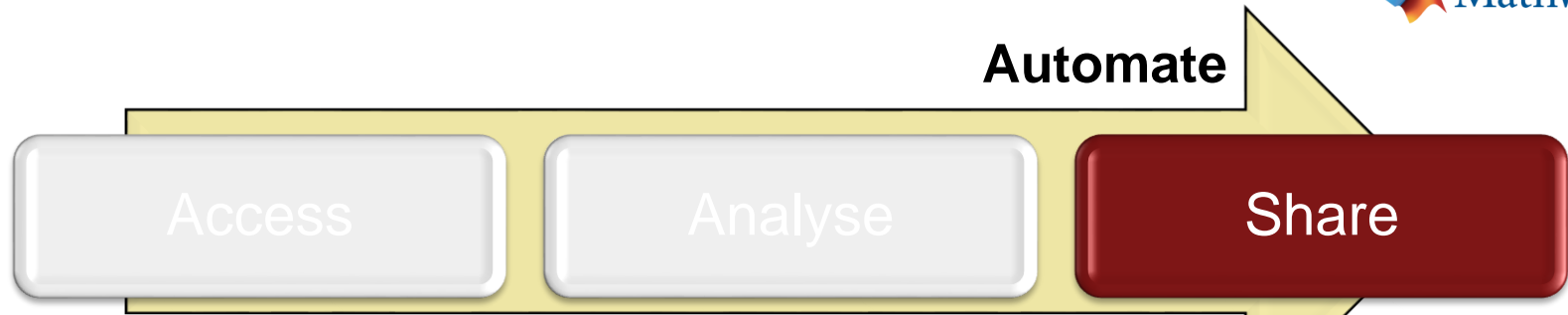
- Manipulate, preprocess, and manage data
- Fast, accurate analysis with pre-built math and engineering functions

Visualize data  
 Compute  $\zeta$  for single file  
 Run over all files batch processing

- Visualization

- Built in graphics functions for engineering and science (2D, 3D)
- Interactive tools to annotate and customize graphics





- Automatically generate structured reports
  - Published MATLAB files
  - MATLAB® Live Editor
- Create apps and toolboxes
  - App designer
  - Package Toolbox
- Deploy applications to other environments



## ***Benefits of MATLAB for data analysis applications***

- Easy to prototype and find solutions
- Automatic code generation accelerates process
- Single software for the entire workflow

