# Plan Overview

A Data Management Plan created using DMPonline

Title: Trapping fluid interfaces using softness

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Project abstract:

Displacement flows, in which a fluid layer is pushed out by the same fluid or a fluid with different properties, are common both in nature and industry. Examples include air bubble displacing liquid secreted by the lung epithelium during the first breath of a newborn, or oil displacement between permeable rock by injected doped water during oil recovery. Such flows are challenging to study, because the interface between two fluids is often unstable and develops complicated patterns.

Multiphase (i.e. containing two fluids separated by an interface) displacement flows are particularly common in microfluidic, in which small volumes of fluids are pushed though networks and circuits of micrometric chambers and tunnels. Such systems have a wide range of applications, from design of thermic flow sensors and micropumps to everyday diagnostic devices, such as rapid lateral flow tests. Majority of microfluidic devices are operated using active components (e.g. pumps) that rely on external control and actuation and have fixed geometry. However, new generation devices contain soft components that deform in response to the flow, thus reducing the need for external actuation, and making them more reliable and deployable more widely. Here we proposed to study displacement flows in three model systems with bounded soft elements. These systems form the basic components of all fluidic circuits: a solid tube lined by a thick layer of soft material, a rectilinear microchannel with portion of one of the walls replaced with a soft material and a circular cell formed by a small gap between a rigid wall and bounded soft wall (in which the displacement flow is radially outwards).

Our preliminary observations suggest that soft elements in these devices can deform in response to the multiphase displacement flow, resulting in creation of constrictions either near their outlet and/or localized constriction around the moving interface of the flow. Beyond critical values of parameters, the constrictions can even close the outflow completely, i.e. choke the flow, or trigger choking near the interface, thus segregating the two fluids into separate regions. Furthermore, the morphology of the interface (e.g. if it is patterned or not) significantly affects the deformation of elastic components in these systems. The goal of this project is to combine experiments with theoretical/numerical analysis in order to understand and develop strategies for manipulating choking phenomena to our advantage, thereby informing, e.g., the design of new types of microfluidic fuses, flow limiters, and filters in microfluidic devices.

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# Trapping fluid interfaces using softness

## Manchester Data Management Outline

1. Will this project be reviewed by any of the following bodies (please select all that apply)?

- Funder

2. Is The University of Manchester collaborating with other institutions on this project?

- Yes - Part of a collaboration and owning or handling data

The projects will be done in collaboration with the Engineering Department at the University of Oxford. Both experimental and numerical data will be shared between institutions prior before research papers get published.

3. What data will you use in this project (please select all that apply)?

- Acquire new data
- Re-use existing data (please list below)

New experimental and numerical data will be acquired; preliminary experimental data (calibrated movies of the phenomenon) used to build the application will be used as well.

4. Where will the data be stored and backed-up during the project lifetime?

- University of Manchester Research Data Storage Service (Isilon)
- P Drive (postgraduate researchers and students only)
- Other storage system (please list below)

As large amount of data will be generated, and not all of will be clean data (i.e. we expect to spend long time designing experiment/numerical simulations), we will also use external hard drives for more temporary data before storing high quality data on Isilon.

5. If you will be using Research Data Storage, how much storage will you require?

- 1 - 8 TB

Data will consist of high quality movies, so we will require between 1 and 8 TB of storage space.

6. Are you going to be receiving data from, or sharing data with an external third party?

- Yes

With collaborators at the University of Oxford.

7. How long do you intend to keep your data for after the end of your project (in years)?

- 5 - 10 years

Guidance for questions 8 to 13

Highly restricted information defined in the Information security classification, ownership and secure information handling SOP is information that requires enhanced security as unauthorised disclosure could cause significant harm to individuals or to the University and its ambitions in respect of its purpose, vision and values. This could be: information that is subject to export controls; valuable intellectual property; security sensitive material or research in key industrial fields at particular risk of being targeted by foreign states. See more examples of highly restricted information.

If you are using 'Very Sensitive' information as defined by the Information Security Classification, Ownerships and Secure Information Handling SOP, please consult the Information Governance Office for guidance.

Personal information, also known as personal data, relates to identifiable living individuals. Personal data is classed as special category personal data if it includes any of the following types of information about an identifiable living individual: racial or ethnic origin; political opinions; religious or similar philosophical beliefs; trade union membership; genetic data; biometric data; health data; sexual life; sexual orientation.

Please note that in line with data protection law (the UK General Data Protection Regulation and Data Protection Act 2018), personal information should only be stored in an identifiable form for as long as is necessary for the project; it should be pseudonymised (partially de-identified) and/or anonymised (completely de—identified) as soon as practically possible. You must obtain the appropriate ethical approval in order to use identifiable personal data.

8. What type of information will you be processing (please select all that apply)?

- Audio and/or video recordings
- No confidential or personal data

9. How do you plan to store, protect and ensure confidentiality of any highly restricted data or personal data (please select all that apply)?

- Not applicable

10. If you are storing personal information (including contact details) will you need to keep it beyond the end of the project?

- Not applicable

11. Will the participants' information (personal and/or sensitive) be shared with or accessed by anyone outside of the University of Manchester?

- Not applicable

12. If you will be sharing personal information outside of the University of Manchester will the individual or organisation you are sharing with be outside the EEA?

- Not applicable

13. Are you planning to use the personal information for future purposes such as research?

- No

14. Will this project use innovative technologies to collect or process data?

- Yes, and innovative technologies will not collect or process personal data (please list the innovative technologies below)

Neural networks might be used to process data.

15. Who will act as the data custodian for this study, and so be responsible for the information involved?

Draga Pihler-Puzovic

16. Please provide the date on which this plan was last reviewed (dd/mm/yyyy).

2023-10-01

## 0. Proposal name

0. Enter the proposal name

Trapping fluid interfaces using softness

## 1. Description of the data

### 1.1 Type of study

Research project that involves experiments and numerical simulations.

### 1.2 Types of data

Movies, numerical data (tables of numbers)

### 1.3 Format and scale of the data

Format will include png & jpeg images, different text formats.

## 2. Data collection / generation

### 2.1 Methodologies for data collection / generation

Experimental data that involves movies of propagating fingers and bubbles in different flow cells; corresponding pressure measurements and measurements of deformation.
Numerical data obtained from simulations of the experimental system.

### 2.2 Data quality and standards

High quality movies; long tables of numbers.

## 3. Data management, documentation and curation

### 3.1 Managing, storing and curating data

In short term, we will use hard drive to store data, before cleaner data is transferred to Isilon.

### 3.2 Metadata standards and data documentation

Descriptions of the recorded movies, processed experimental and numerical data.

### 3.3 Data preservation strategy and standards

Matlab/python file will be generated to process and display data; readme files will be generated as well and supplied along with raw data files.

## 4. Data security and confidentiality of potentially disclosive information

### 4.1 Formal information/data security standards

N/A

### 4.2 Main risks to data security

N/A

## 5. Data sharing and access

5.1 Suitability for sharing

Data contains no personal information. The research is of fundamental value, so can not be commercialised in a short-term, and can be shared freely once the research is completed.

5.2 Discovery by potential users of the research/innovation data

Data will be supplied as supplementary material with our publications. We tend to publish with journals with open access, to supply pre-prints to the University of Manchester library, so the data will be freely available.

5.3 Governance of access

See previous question.

5.4 The study team's exclusive use of the data

The data will be available to the research team exclusively while the research project lasts. Once the work gets published, all data will become available publicly.

5.5 Restrictions or delays to sharing, with planned actions to limit such restrictions

There will be no restrictions as the data contains to personal data.

5.6 Regulation of responsibilities of users

We have shared the data so far without formal agreement - there is no risk associated with it.

## 6. Responsibilities

6. Responsibilities

Postdoc and PhD students will also generate data and will be responsible for storing it securely.

## 7. Relevant policies

7. Relevant institutional, departmental or study policies on data sharing and data security

| Policy | URL or Reference |
| --- | --- |
| Data Management Policy & Procedures | https://documents.manchester.ac.uk/display.aspx?DocID=33802 |
| Data Security Policy | No personal data |
| Data Sharing Policy | No personal data |
| Institutional Information Policy | |
| Other | |
| Other | |

## 8. Author and contact details

8. Author of this Data Management Plan (Name) and, if different to that of the Principal Investigator, their telephone & email contact details

The same as the PI.