MATLAB Project

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In this project, we want to access data obtained from a 0D simulation of the cardiovascular system, extract some relevant variables and compute / plot relevant hemodynamic values. The code has been tested on MATLAB R2019b on Mac on 12.12.2019.

data structure

The structure of data is a level-4 MAT-file. It is a sequence of matrices of the following sequence:

|  |  |
| --- | --- |
| Aclass | Gives information about the version, the name of the model and the format. |
| name | Contains the name of all variables / parameters / constants. **The n-row contains the n-variable**. |
| Description | Description of each variable |
| dataInfo | Information on how and where each variable is stored |
| Data\_1; …, data\_n | Results of the simulation |

comments about data structure

**Aclass**: First line is always the string 'Atrajectory'. Second line is the version. Third line is the name of the model. Fourth line gives the format of the following matrices: binNormal (non-transposed) or binTran (transposed). In our case :

'Atrajectory '

'1.1 '

'Mathcard.Applications.Ursino1998.Ursino1998Model '

'binTrans '

**name**: In our case, the matrix needs to be transposed in order to be readable (binTrans).

**description**: If there is no comment in the model, the line is leaved blank.

**dataInfo**: Is a (4,n)-size matrix where n is the number of variables. CAVEAT, the following table concerns binTrans data!

|  |  |
| --- | --- |
| dataInfo(1,n) = j | n variable is stored in matrix data\_j |
| dataInfo(2,n) = k | n variable is stored in row abs(k) of matrix data\_j |
| dataInfo(3,n) | Always 0 |
| dataInfo(4,n) | Always -1 |

**Data\_n**: In our case, there is only Data\_1 and Data\_2.

CODE DESCRIPTION

**Script to run**: ScriptDataTreatment.m

**Functions called by ScriptDataTreatment.m**: ExtractResults, TimeRange, LoadData, MeanPressure, LeftVentricularEjectionFraction, HeartRate

**ScriptDataTreatment.m:**

* Load the .mat file
* Define the total time of simulation, and the interval time we want to analyze
* Extract results for the following variables:
  + Left atria pressure
  + Left ventricle pressure
  + Left ventricle volume
  + Right ventricle pressure
  + Right ventricle volume
  + Flow through aortic valve
  + Systemic arterial pressure
  + Arterial systemic systolic and diastolic values
  + Pulmonary arterial pressure
  + Arterial pulmonary systolic and diastolic values
* Compute the following hemodynamic parameters
  + Compute left ventricle ejection fraction
  + Compute mean systemic arterial pressure
  + Compute mean pulmonary arterial pressure
  + Compute capillary wedge pressure
  + Compute aortic flow and cardiac index
* Plot and save the graphs
  + Plot Pressure - Volume Curve for left and right ventricles
  + Plot systemic arterial pressure
  + Plot pulmonary arterial pressure
  + Save plots in the .eps format
* Save data
  + Save data in the .cvs format

**LoadData:** Load the data.

**ExtractResults.m:** Localizes a given parameter in the data, extracts it and returns it and the time vector.

**TimeRange.m:** Extract the variable for a given interval of time.

**MeanPressure.m:** Compute the mean arterial pressure.

**LeftVentricularEjectionFraction.m:** Compute left ventricular ejection fraction

**HeartRate:** Compute heart rate.