IBEHS 4QZ3 Modelling of Biological Systems – Assignment 2 2021

Individual assignment due Friday October 17th, 2021 11:59pm to the avenue dropbox. Submit one PDF, with all code included in an appendix.

1. **(20 Marks)** In lecture we developed a mathematical model of the circulatory system, primarily centered around cardiac physiology. Continue where I left off in lecture by adding the functionality of the left ventricle. So, as per lecture, expand the model to include left ventricle (LV), a basic pump "accepting fluids at low pressure (P1) then transferring to a region where pressure is higher (P2>P1)", taking note that muscular contractions will change LV wall compliance, producing increased diastolic compliance and decreased systolic compliance. Set some initial conditions (see **Q1_init.m** for an example).

2.   **(15 marks)** Develop a model for oral consumption of an anti-inflammatory drug. Consider one route of absorption (gut wall) and three routes of loss from the blood (liver, kidney, and cellular uptake). If the drug half life in the gut lumen is 15 minutes (i.e. absorption rate constant) and metabolism (liver) is 90 minutes, renal clearance is 30 minutes, and absorption by the cells of the body is 75 minutes, how often should the drug be taken (orally) to maintain a blood concentration of at least 75% of the dose (but not to exceed 125% of the dose). List any assumptions. Is the concentration in the blood constant over time?