

## The mathematical Heart

Our heart is a clock with the best battery that we can find in the world. In any moment we can stop ourselves and hear the unique *tick tock* of our heart that works each second of our life. Nowadays, all we know the importance of regular heart rhythm. Its electric activity is recorded by the electrocardiography (ECG), which has been casted as background actor in serial TVs as “E.R.” and “Grace Anatomy”.

However it happens sometimes that the generator of the single beat does not work properly, in this case an irregular rhythm is possible: the clock hand becomes faster or slower. Since the most widespread irregular rhythm among population is the Atrial Fibrillation (AF), we decided to study in deep the generation of the heartbeat.

The non-invasive mathematical model based on ECG information has been developed through a collaboration between Politecnico of Milan and Lund University. The model may be compared to the traffic during the rush hour. Imagine a long queue of cars, where each of them represents an atrial impulse, starting from the same point defined as sinoatrial node (SA). At the end of the route there is a traffic officer that has the task to steer the traffic, according to the probability  $\gamma$ , between two roads: the fast highway and the slow route. In both the roads, there is a rail crossing that let only few cars to pass. The final destination is the same for both of them represented by the ventricles. All the atrial impulses that can reach the AV node will become heartbeats.

In conclusion, the model gives a key of reading of the heart electrophysiology during AF. Indeed, the cardiologists might know characteristic times and rate of the AV node. At that moment, there are future perspectives to use our model in clinician applications.

