

Application of Random Matrix Theory on heartbeat dynamics

A. Knežević ¹, M. Martinis ¹, G. Krstajić ², E. Vargović ³

¹*Rudjer Bošković Institute, Zagreb, Croatia*

²*Institute for Cardiovascular Disease and Rehabilitation, Zagreb, Croatia*

³*CDV info, Zagreb, Croatia*

Fluctuations of heartbeat (RR) intervals in ECG are studied and compared with the predictions of Random Matrix Theory (RMT). Of particular interest is observing differences in fluctuation patterns for healthy and diseased subjects. The case of coronary heart disease - stable angina pectoris are examined.

It is found that RR intervals only locally exhibits the fluctuation patterns (universality) predicted by the RMT. The complex heartbeat dynamics is of the mixed type, where regular and irregular (chaotic) regimes coexist. The Brody and the Berry-Robnik type of nearest neighbour distributions are tested for structure sensitivity. It is seen that a parameter of the Brody distribution could be a useful value for observing differences between healthy and diseased states, even for short-time data series.

References:

- M. L. Mehta, Random Matrices, Academic Press, San Diego, 1991.
- T. A. Brody, Lett. Nuovo Cim. 7 (1973) 482.
- M. V. Berry and M. Robnik, J. Phys. A 17 (1984) 2417.