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Prof. Ing. Igor Jex
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Dear Prof. Ing. Igor Jex:

The following is my report on Ing. Kateřina Medková's Ph.D. thesis submission.

The thesis is broadly in the area of combinatorics on words and focusses specifically on three important and related families of infinite words: Sturmian words, Arnoux–Rauzy words, and complementary symmetric Rote words. The family of Sturmian words is one of the most famous and important families of words in this area. Arnoux–Rauzy words are a natural generalization of the Sturmian words from the binary alphabet to larger alphabets, and complementary symmetric Rote words are constructed from Sturmian words in a very simple way. This thesis studies the following properties of these words: derived sequences, non-repetitive complexity, and critical exponent. These are all important properties of infinite words. This thesis therefore represents an excellent choice of topic in the area of combinatorics on words.

The thesis begins with a chapter of preliminaries, where all the main concepts needed to understand the main results of the thesis are defined and all relevant prior work on the subject is referenced. This is actually quite an extensive chapter, since a large amount of background material is needed for this thesis. This is followed by a detailed summary of the main results of the thesis. Essentially the main lemmas and theorems of the thesis are collected in this chapter without proofs. The remainder of the thesis consists of five research papers that have either been already published or submitted for publication. In my opinion, a thesis consisting of five research papers is exceptional. I would consider two research papers worth of material to be sufficient for a Ph.D. thesis, so five papers worth of material is truly outstanding.

The five papers are closely related and all are largely based on the theory of return words and derived sequences. This theory has proven to be a very useful tool in the study of infinite words and the author has used this tool very well to obtain some very interesting results.

In her first paper, the author gives an algorithm to find the morphisms that generate the derived sequences of Sturmian words that are fixed points of morphisms. Her second paper extends the study of derived sequences to Arnoux–Rauzy words, which are generalizations of Sturmian words to larger alphabets. The third paper characterizes the derived sequences of any CS Rote word obtained from a standard Sturmian word. The fourth paper derives a formula for the non-repetitive complexity of Arnoux–Rauzy words, thereby extending the previous work of Nicholson and Rampersad on the Fibonacci and Tribonacci words. The last paper obtains a formula for the critical exponent and recurrence function of CS Rote words, the study of which was motivated by previous work of Baranwal and Shallit, and Currie, Mol, and Rampersad on the critical exponent of rich words. The topic of critical exponents is a major one in combinatorics on words and the results here are a big contribution to the study of this topic.

Each one of these five papers is of very high quality. The results are significant and are on topics of major current interest in the area of combinatorics on words. The techniques developed are very powerful and will surely be useful in future work on these topics. In my opinion, this thesis is very impressive work and should without question be accepted for presentation and defense.

Sincerely yours,

Narad Rampersad