PREFACE:
SPECIAL ISSUE ON THE ČERNÝ CONJECTURE

A bit of History: is the Černý Conjecture 55 or 50 Years old?

This special issue of the *Journal of Automata, Languages and Combinatorics* is dedicated to the Černý Conjecture, arguably the most longstanding open problem in the combinatorial theory of finite automata. The conjecture claims that every synchronizing automaton with n states has a reset word of length $(n-1)^2$.

How old is this conjecture, actually? In the vast literature on the Černý Conjecture and related issues, it is quite common to refer to Ján Černý's paper [1] as the source of the conjecture. This seminal paper published in Slovak language exactly 55 years ago is remarkable in many respects but the conjecture was not yet stated there. Now the reader can easily verify the latter claim by browsing through the English translation of [1] in the present special issue. It appears that the conjecture first appeared in print two years later, namely, in the note [4] by Peter H. Starke published in German in *Elektronische Informationsverarbeitung und Kybernetik*, the predecessor of our journal. The present issue includes also the English translation of [4], and the reader is invited to look at the concluding remark of the translation (p. 137 in this issue) to see what I have in mind.

It is known that Černý discussed synchronizing automata (which he called *directable*) and the conjecture on the length of their reset words at several Czechoslovak conferences held in the second half of the 1960s, in particular, at the fourth Prague Conference on Information Theory, Statistical Decision Functions, Random Processes (Prague, August 31 – September 11, 1965) and at the Bratislava Conference on Cybernetics in 1969; some authors allocate Černý's conjecture to his communication at the latter event. However, the first publication by Černý (joint with Alica Pirická and Blanka Rosenauerová, [2]) in which the conjecture was explicitly mentioned appeared only in 1971. Thus, perhaps, the name "Černý–Starke Conjecture" would be more accurate from the historic viewpoint but it is far too late to modify the terminology that has been in use for more than four decades[1]. Still, I would like to emphasize the contributions of Starke: in [4], he gave the first polynomial in n upper bound on the minimum length of reset words for synchronizing automata with n states, and his book [5] as well as its English translation was essential in spreading out the ideas of [1] and attracting researchers' attention to synchronizing automata. So, let the

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[1]I tried but was not able to precisely locate the earliest occurrence of the name "Černý Conjecture" in the literature; certainly, it has been present since the end of the 1970s, see, e. g., [3].

present issue of our journal serve also as a tribute to Peter H. Starke, a pioneer of Automata Theory and a long-term editor of *Elektronische Informationsverarbeitung und Kybernetik*, who passed away on June 9, 2019.

Ján Černý, Turku 2004

Peter H. Starke, Berlin 1995

Overview of the Special Issue

Besides the English translations of the foundational papers [1] and [4], the present issue contains 12 original contributions. These contributions constitute a snapshot of the current state of the theory of synchronizing automata. They represent several important facets of the theory: new lower and upper bounds on the minimum length of reset words (papers by Ananichev/Vorel, Don/Zantema, Shitov, and Volkov), new algorithms for checking synchronization and generating slowly synchronizing automata (papers by Ageev and Catalano/Jungers), complexity-theoretical and probabilistic issues (papers by Fernau/Hoffmann, Gonze/Jungers, and Nicaud), extensions of the synchronizability concept to matrices and new species of automata (papers by Catalano/Jungers and Chistikov/Martyugin/Shirmohammadi), various connections to formal languages (papers by Carpi/D'Alessandro and Frigeri/Rodaro). I am quite sure that everyone working or planning to work with synchronizing automata will find here something useful and appealing.

Acknowledgements

As the guest editor, I thank all the colleagues who kindly accepted my invitation to contribute to the special issue. Also, I thank Prof. Ján Černý for providing an English translation of [1] and granting his permission to include the translation in the

special issue. I feel greatly indebted to the late Prof. Peter H. Starke who granted his permission to translate the paper [4] and to publish this translation, and I am grateful to his wife Katrin Starke for her kind support and providing some photos from which we have chosen the one on the previous page. I further thank Prof. Gregory Budzban for providing the photo of Ján Černý.

All submitted papers underwent a rigorous reviewing procedure (and, sorry to say, not all of them were recommended for publication); my cordial thanks go to all the authors for their kind and timely cooperation as well as to the reviewers who did their job thoroughly and also timely.

Last but not least, I am extremely grateful to Dr. Bianca Truthe, the Technical Editor, for the enormous amount of highly qualified work she has done on the issue.

Ekaterinburg, September 2019 Mikhail V. Volkov

References

[1] J. Černý, Poznámka k homogénnym eksperimentom s konečnými automatmi. *Matematicko-fyzikalny Časopis Slovenskej Akadémie Vied* **14** (1964) 3, 208–216. (Translation: A note on homogeneous experiments with finite automata. *Journal of Automata, Languages and Combinatorics* **24** (2019) 2–4, 123–132).

[2] J. Černý, A. Pirická, B. Rosenauerová, On directable automata. *Kybernetika* **7** (1971) 4, 289–298.

[3] J.-E. Pin, Sur un cas particulier de la conjecture de Cerný. In: *5th International Colloquium on Automata, Languages and Programming. Udine, Italy, July 17–21, 1978, Proceedings*. LNCS 62, Springer, 1978, 345–352.

[4] P. H. Starke, Eine Bemerkung über homogene Experimente. *Elektronische Informationsverarbeitung und Kybernetik (later Journal of Information Processing and Cybernetics)* **4** (1966) 2, 257–259. (Translation: A remark about homogeneous experiments. *Journal of Automata, Languages and Combinatorics* **24** (2019) 2–4, 133–137).

[5] P. H. Starke, *Abstrakte Automaten*. Deutscher Verlag der Wissenschaften, 1969. (Translation: Abstract Automata. North-Holland/American Elsevier, 1972).