

# 70TH BIRTHDAY OF PROFESSOR ERNEST JUCOVIČ

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On August 6th, 1996 Professor Ernest Jucovič celebrated his 70th birthday. He was born in Liptovský Hrádok. Prof. Jucovič graduated from the Faculty of Education of Charles University in Prague (1946 - 1950). After teaching for one year at a secondary school and working for two years in a publishing house he continued his teaching career at the High Pedagogical School (later Faculty of Education of the Šafárik University) in Prešov. Since 1966 until his retirement he was a Lecturer and later a Professor at the Faculty of Natural Sciences in Košice. He obtained his Associate Prof. (Docent) degree from the Technical University in Košice (1961), his DrSc. (Doctor of Sciences) in 1974 and became Professor in 1977.

His main scientific interest is in combinatorial geometry and related mathematical areas. He achieved many interesting results on the metric and combinatorial properties of convex polytopes and he studied relations within convex polytopes and between them and related spherical shells. Two of his works are about non-inscribable polytopes. He was later interested in those types of polytopes whose all vertices can lay on a spherical shell. Self-dual polytopes represent a special field of his interest. In [27] he analyzed the minimal length of a maximal cycle in the graph of convex polytopes with faces of the same type. In papers [17], [21] and [32] he has been dealing with colouring problems in combinatorial structures.

We mention in more detail a topic which was, due to his impulse, intensively studied in Košice, and which received a good international response. Let  $p_k(\mathbf{M})$  or  $v_k(\mathbf{M})$  denote the number of faces or vertices of a decomposition  $\mathbf{M}$  of an orientable 2-manifold of genus  $g$  which are incident with exactly  $k$  edges. Give necessary and sufficient conditions for a pair of sequences  $p = \{p_k | 3 \leq k\}$  and  $v = \{v_k | 3 \leq k\}$  of non-negative integers for which there exists a decomposition  $\mathbf{M}$  such that  $p_k(\mathbf{M}) = p_k$  and  $v_k(\mathbf{M}) = v_k$  for all  $k$ . Sequence  $p$  is called the face-vector and sequence  $v$  the vertex-vector of  $\mathbf{M}$ . (Note that, for  $g = 0$ , by Steinitz's theorem,  $\mathbf{M}$  is combinatorially isomorphic to a 3-dimensional convex polytope if and only if the graph of  $\mathbf{M}$  is 3-connected.) From Euler's formula the following conditions for the face-vector and vertex-vector of  $\mathbf{M}$  can be derived

$$\sum_{3 \leq k} (6 - k)p_k(\mathbf{M}) + 2 \sum_{3 \leq k} (3 - k)v_k(\mathbf{M}) = 12(1 - g) \quad (1)$$

$$\sum_{3 \leq k} (4 - k)(p_k(\mathbf{M}) + v_k(\mathbf{M})) = 8(1 - g) \quad (2)$$

Conditions (1) or (2) do not impose restrictions on the numbers  $p_6(\mathbf{M})$  and  $v_3(\mathbf{M})$  or  $p_4(\mathbf{M})$  and  $v_4(\mathbf{M})$ , respectively. In 1891, a German mathematician Victor Eberhard proved: If a sequence  $p = \{p_k | 3 \leq k \neq 6\}$  of non-negative integers satisfies the condition  $\sum_{3 \leq k} (6 - k)p_k = 12$ , then there is at least one value  $p_6$  such that there exists a convex polytope  $\mathbf{M}$  having every vertex of degree 3 and  $p_k(\mathbf{M}) = p_k$ , for all  $k \leq 3$ . A similar result for 4-valent polytopes has been proved by Branko Grünbaum in 1967. These two results appear to be the first step for solving the following problem: Characterize the face-vectors and vertex-vectors of the decompositions of closed orientable 2-manifolds of genus  $g$ . Prof. Jucovič published a number of papers on the necessary and sufficient, or only sufficient conditions for the existence of a pair of numbers  $(p_6, v_3)$  (or  $(p_4, v_4)$ ) such that given sequences of non-negative integers  $p = \{p_k | 3 \leq k \neq 6\}$  and  $v = \{v_k | 4 \leq k\}$  with  $p_6, v_3$  (or  $p = \{p_k | 3 \leq k \neq 4\}$  and  $v = \{v_k | 3 \leq k \neq 4\}$  with  $p_4, v_4$ , respectively) are the face-vector and vertex-vector of some decomposition. He published the first definitive results about the decomposition of surfaces of genus  $g \geq 1$ . In the proof new methods and constructions different from planar case have been used. More information can be found in the monograph Convex Polytopes [49]. Another study the decompositions can be found in [36] and [38]. In the first of them the existence of nearly regular decomposition with at most two exceptional cells (vertices or faces) was studied. In the second one he investigated planar decompositions with the constant sum of vertices incident with every edge.

Prof. Jucovič was also active in pure geometry - he wrote papers on coverings and packings inspired by the Hungarian geometrical school and in particular by L. Fejes-Tóth. In [39] necessary and sufficient conditions for the existence of packing of domains in the Euclidean plane are given.

Prof. Jucovič achieved several fundamental results in his work, he elaborated constructions, solved famous problems, formulated new problems and showed solutions of some of them. His results are frequently cited, e.g. the monographs of B. Grünbaum, C. Berge and others. A name the co-authors of some of his works are B. Grünbaum, D. Barnette, J. W. Moon.

After having arrived to Košice Prof. Jucovič created a combinatorial seminar, which became famous in Slovakia and abroad. He attracted and stimulated a remarkable number of young people whom he helped a great deal in their scientific growth.

Prof. Jucovič is not only a scientist - he also dealt with the questions of mathematics education; published a considerable number of expert papers and is a co-author of acclaimed text-books on geometry and methodology.

As a researcher and excellent organiser of research life Prof. Jucovič is known for his great enthusiasm, high demands, punctuality as well as deeply human approach towards students and subordinates. Also on this field his work shows traces of the strength with which he pursues his goal.

Upon the occasion of his seventies we all wish Prof. Jucovič a good health and happiness in his life.

*Remark.* Prof. Jucovič died in October 21, 1998.

## List of publications by Professor Ernest Jucovič

## Scientific papers

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- [4] *Samosoprjažennyye  $K$ -poliedry*, Mat.-fyz. časopis **12**(1962), 1–22.
- [5] *O niektorých vlastnostiach hrán autokonjugovaného  $K$ -polyédra*, Mat.-fyz. časopis **12** (1962), 203–208.
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- [7] *Zametki o rebrach  $K$ -poliedra*, Mat.-fyz. časopis **14**(1964), 3–5.
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- [9] *O mnohostenoch bez opísanej guľovej plochy I*, Mat.-fyz. časopis **15**(1965), 90–94.
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- [15] *Poznámka o cestách v štvoruholníkových polyédrických grafoch*, Časopis pro pěstování matematiky **93**(1968), 69–73.
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- [17] *On a problem in map colouring*, Mat.-fyz. časopis **19**(1969), 225–227.
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- [21] *Colouring the edges of a multigraph* (J. Fiamčík), Archiv d. Math. **21**(1970), 446–448.
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- [32] *On chromatic and achromatic numbers of uniform hypergraphs* (F. Olejník), *Časopis pro pěstování matematiky* **99**(1974), 123–130.
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- [40] *On generalized neighbour packings of domains in the euclidean plane* (S. Ševců), *Studia Scien. Math. Hungarica* **21**(1986), 347–358.
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